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MADISON BENTLEY, UNIVERSITY OF ILLINOIS (*Index*)

Mental Measurements of the Blind

A Provisional Point Scale and Data for a Year Scale

By

THOMAS H. HAINES, Ph.D., M.D.

Clinical Director of the Bureau of Juvenile Research, Columbus, Ohio, and Professor of Psychology, Ohio State University

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MENTAL MEASUREMENTS OF THE BLIND

A PROVISIONAL POINT SCALE AND DATA FOR A YEAR SCALE[1]

I

Plan of the Survey and the Selection of Tests

This report embodies the results of a psychological survey of the Ohio State School for the Blind, conducted for the most part in the month of May, 1915. The initiative for this survey came from Mr. R. B. Irwin, Supervisor of the Education of the Blind, Cleveland, Ohio. In his work Mr. Irwin had come to feel the imperative need of mental tests for the Blind, by which the definitely feeble-minded could be eliminated from the public schools, and given the special education demanded by their defective mentalities. Mr. Horace Maurer, Superintendent of the Ohio State School for the Blind, and the Ohio Board of Administration, were very cordial in their reception of the suggestion that such a survey be made. The superintendent of the school had realized the fact that there were many feeble-minded children in the school, and as the law explicitly states that the school is for "blind persons, residents of the State, such as the trustees and superintendent are satisfied from reliable information and examination, are of suitable age and mental capacity to receive instruction by the methods pursued in the school," it was important, both to have the information as to who were feeble-minded in the school, and to have means put into hand, in the shape of tests, by which candidates for admission in the future might be effectively tested in respect to intelligence. It is evident that cursory examinations, such as physicians are now conducting, are not effective in eliminating the feeble-minded from amongst the candidates for admission. The actual examinations were made by Miss Alida C. Bowler and the writer. Much of the correla-

[1] Contributed from the Bureau of Juvenile Research, Columbus, Ohio.

tion of the data, and calculating of averages, was done by Miss Bowler. Dr. Rudolf Pintner made some valuable suggestions in regard to presentation of data.

The tests used were gathered from various sources. Mr. Irwin had gained many suggestions from Dr. Goddard and his fellow-workers at Vineland, N. J. Many of Mr. Irwin's own suggestions are incorporated. Tests suggested by Terman and Pintner are also used.

Work with the Yerkes-Bridges Point Scale in the examination of juvenile delinquents in Ohio had already convinced the writer of the economy of the Point Scale over any other modification of the Binet-Simon Scale, and also of its greater efficiency, both in its aim to measure more definitely psychological processes, and in affording a more ready means of comparison of one person's mentality with that of another. Our results from fifty-two totally blind persons, considered to be of normal intelligence, have already afforded a means of comparison of data from one subject with those from others, which means more for the mental assessment of each one of these fifty-two persons, and of several others of inferior mental endowment, than do results, more laboriously obtained by the Binet Scale. The Point Scale for the Blind, even with this preliminary try-out, reveals its value as a means of throwing suspicion upon the intelligence of several inferior blind children; and of reaching the decision that some others are feeble-minded. On account of the efficiency already shown, and in order to invite the accumulation of further data, these results are put forth as a provisional Point Scale for the measurement of the intelligence of the Blind. We wish it distinctly borne in mind that the scale is only provisional, inasmuch as it has been tried on such a small number of persons. One of the chief recommendations of the Point Scale as such, is that the norms are continually perfected as data are accumulated. They are never perfect. Data from one thousand blind children will be much more reliable than data from fifty. The data from these fifty-two subjects are presented in such form, that they may be added to at any time.

The Yerkes-Bridges Point Scale[2] was accordingly adapted to

the blind by substituting tests suitable for the blind, for a number which could not be administered to them. The following tests were eliminated from the Yerkes-Bridges Point Scale. The numbers given in each case are those found in the revised Point Scale as given on pages 136-7 of "A Point Scale for Measuring Mental Ability."

1. Chooses, twice, prettier in each of three pairs of pictures.
2. Sees picture lacks; (a) arms; (b) nose; (c) mouth; (d) eyes.
3. (a) Compares, twice, lines 5 and 6 cm.
7. Reaction to three Binet pictures. Enumeration, description, or interpretation.
11. Resists suggestions.
12. Copies (a) square; (b) diamond.
16. Draws designs from memory.

For some of these tests, substitutes, more or less adequate, were found. For the choice between two pictures, Irwin's suggestion of the choice between the tactual impressions made by feeling two fabrics was substituted. Comparisons adopted were:

(a) serge and silk.
(b) velvet and serge.
(c) velvet and Brussels carpet.

For the lacking elements in a picture no substitute was found. For the 5 and 6 cm. lines were substituted (Irwin) 4 cm. and 6 cm. sticks. These sticks were round and 7 mm. in diameter, and were put into the subject's two hands with the request, "Give me the longer stick." For the first part of the reaction to three Binet pictures (enumeration), was substituted (Irwin) a box or basket containing a doll, baby shoe, shoe-string, marble, penny, baseball, coat button, and a teaspoon. Simply naming these articles as they were taken out of the box constituted passing the test. For the lines, used as visual stimuli in the *resisting suggestion* test, were adopted, (Irwin) cubes of wood, measuring 15 mm., 22 mm., 29 mm., and 36 mm. These were used in pairs,

[1] See "A Point Scale for Measuring Mental Ability," Yerkes, Bridges, & Hardwick—Baltimore, 1915.

beginning with the smaller, and putting one into each hand of the subject. The larger of the two was put into the right hand, in the first three of the six trials, and then, without changing the method, two 36 mm. cubes were put into the two hands three times over. For the two *drawing tests,* copying square and diamond, and drawing from memory, no parallel substitutes were found for the blind.

Further additions were made to the Point Scale for the Blind. The numbers given are those found on the Point Scale for the Blind as given on pages 6 and 7.

2. Size-Weight Illusion. (Goddard.) Two wooden cylinders of equal weight (55 gm.) and each 35 mm. long, but of different diameters, one being 19 mm. and the other 61 mm. in diameter, were put into the two hands of the subject, and he was asked to give to the examiner the heaviest one. This was repeated with the larger cylinder in the other hand.

4. Memory for digits. To the Yerkes-Bridges span for digits was added another item. The subject was tested, if he repeated seven digits, on an eight digit span.

6. Adaptation Board (Goddard). We scored on the first two *changed* positions of Pintner's procedure, described later.

10. (a) Touches examiner's right hand. The examiner, sitting opposite S. with his hands upon his knees, informs S. fully of these facts, and asks S., after due deliberation, to touch his (E's) right hand (Irwin).

(b) Orientation. S., standing and facing north is asked to point out the other three cardinal points of the compass. Likewise standing and facing east, he is asked to point out in turn, the other three points of the compass (Irwin).

13. Finger Tapping. Knox Lines. The blind subject is given the Knox lines upon the palmar surface of the distal joints of the fingers of his left hand (if he is right handed). The forefinger is considered point *one* just as the cube at S.'s left is considered point *one* in the Knox cube tests; and so on, *two, three* and *four* are the fingers toward and including the little finger, the little finger being point *four.* The fingers are touched with the rubber end of a pencil, the pencil is put into S.'s right hand,

and he is asked to do just what E. has done with the pencil in touching his own fingers.

15. Reversing series of digits, three digits to six, inclusive. Terman used three digits reversed as an VIII yr. test, and five digits reversed as a XII yr. test.

Slight changes were necessary in the methods of using two of the Yerkes-Bridges Point Scale tests, which were retained, using three given words in a sentence, and arranging disarranged sentences.

17. Composing a sentence containing three given words. The blind subject could not conveniently write the sentence. Instructions were given very much as to a seeing subject; the three words were mentioned at least three times; and the statement was made at least twice, and these words were to be made into *one* sentence. He was asked to give the sentence orally, as soon as he had it ready. This procedure is not a marked departure from current methods for this test, as many examiners with seeing children are now writing the sentence themselves, asking the subject to give it orally.

22. The disarranged sentences were printed in New York Point, each one being printed on a single line. The lines were separated by wide spaces. The subject was asked to read the top line aloud. He was then told in detail that these words had been shuffled from a sentence,—mixed up like cards in a pack when shuffled, and his problem was to make a good sentence out of the words, using each word he had read, and using no word twice. The words were then repeated to him and the time noted. He read the words with his fingers as often as he liked.

The Point Scale for the Blind, a replica of our record blank, is given on pages 6 and 7. Description of the tests and the procedure in giving them follows.

DATE .....

EXAMINED BY .....

NAME ..... BORN .....

HOME ADDRESS ..... NATIONALITY .....

1. Naming objects in a basket. 5 Objects, (1). All the 8, (2). (2)

2. Size-Weight Illusion, (alternate hands). (2)

3. Repeats: (*a*) It rains. I am hungry. (2)
(*b*) His name is John. It is a very fine day. (2)
(*c*) It is not necessary to hurt the birds.
It is night and all the world rests in sleep. (2)

4. Memory span for digits:

(*a*)	374	581	(1)
(*b*)	2947	6135	(1)
(*c*)	42871	92736	(1)
(*d*)	461572	516283	(1)
(*e*)	2749385	6195847	(1)
(*f*)	37158264	26149738	(1)

5. Compares, twice: (*a*) Wooden cylinders, 4 and 6 cm. long. (1)
(*b*) Weights, 6 and 15 grams. (1)
(*c*) Weights, 9 and 18 grams. (1)

6. Adaptation Board. Over right, (1). Over toward S., (1). (2)

7. Resists suggestions, cubes: (1 for each resistance.) 1.——2.——3.—— (3)

8. Defines: (In terms of use, 1 each; superior to use, 2 each):
(*a*) Chair
(*b*) Horse
(*c*) Fork
(*d*) Baby (8)

9. Chooses the *nicer feeling*, (*a*) serge and silk, (*b*) velvet and serge, (*c*) velvet and carpet (1 each). (3)

10. (*a*) Shows examiner's right hand and left hand. (2)
(*b*) Faced north, points E., W., and S., (1). Faced east, points S., N., and W., (1). (2)

11. Gives words for three minutes: 30-44, (1); 45-59, (2); 60-74, (3); 75—, (4).
1″ 30 sec.——2″——3″——4″——5″——6″——Total. (4)

12. Differences: (*a*) Apple and banana (2)
(*b*) Wood and glass (2)
(*c*) Paper and cloth (2)

13. Finger Tapping. Knox Lines: (*a*) X. Y. (2)
(*b*) B. C. D. (3)
(*c*) E. F. G. (3)

RECORD BLANK FOR POINT SCALE
MENTAL MEASUREMENTS OF THE BLIND

C. M. A..... .....MENTAL AGE.....

.....SCHOOL GRAL.....TOTAL CREDIT.....

14. Counts backward: 20-1, (2). One omission or transposition, (1). (2)

15. Reverses series of digits, (1 of 3)

(*a*)	283	427	395	(1)
(*b*)	6528	4937	4293	(1)
(*c*)	31879	69482	52961	(1)
(*d*)	358164	174928	813692	(1)

16. Comprehends questions: (2 each).
   (*a*) Missed train
   (*b*) Someone unkind
   (*c*) Action versus words
   (*d*) Forgive easier (8)

17. Composes sentence containing *Columbus, money, river,* or three words of equal difficulty.
   Three words in two, (2). Three words in one, (4). (Vary the words). (4)

18. Arranges weights: two trials. All correct but one, (1); correct, (2) (2)

19. Sees absurdity: (1 each)
   (*a*) Unlucky cyclist
   (*b*) Three brothers
   (*c*) Suicide
   (*d*) Eighteen pieces
   (*e*) Last car (5)

20. Defines:
   (*a*) Obedience (2)
   (*b*) Charity (2)
   (*c*) Justice (2) (6)

21. Analogies: (*a*) Oyster is to shell as banana is to
   (*b*) Arm is to elbow as leg is to
   (*c*) Head is to hat as hand is to
   (*d*) Truth is to falsehood as straight line is to
   (*e*) Storm is to calm as war is to
   (*f*) Known is to unknown as present is to (6)

22. Puts disarranged sentences together: (2 each)
   (*a*)
   (*b*) (6)
   (*c*)

II

Instructions for the Point Scale Measurement of the Blind. Giving Tests and Evaluating Responses[3]

1. *Naming objects in a box.* The objects in the box were mentioned above. The box is placed before the subject as E. says to him: "Here is a box in which you will find a number of different things. Please pick them up and name them as you lay them out on the table, one at a time." If he fails to find some of the smaller objects, he should be asked if he is sure he has not missed something. The test is a test of ability to name the objects. Credit two points for all objects named. Seven objects named, one point credit.

2. *Size-Weight Illusion.* Ask the subject to hold his hands upon the table ready to receive what you put into them. Then place simultaneously one of the cylinders in each hand, and ask him to give you the heavy weight. Taking both cylinders, repeat the test, placing the large one in the other hand. Credit two points for both trials correct,—that is, the smaller cylinder judged heaviest. No credit if S. does not get the characteristic illusion in both trials.

3. *Repeating sentences.* Say to the subject: "Listen to me, and when I have finished, say just what I have said." Be sure the subject is attending and then say: "It rains. I am hungry." Likewise, the other pairs of sentences used, (b) and (c). Credit two points for each pair of sentences, (a), (b), and (c) correctly repeated. No credit allowed for any pair of sentences in which an error is made.

4. *Memory for digits.* Begin in the same way as in 3. Repeat the first three digits given, asking the subject to say exactly what you say. Pronounce the numbers without emphasis at the rate

[3] In some cases these instructions follow Yerkes exactly. See "A Point Scale for Measuring Mental Ability," Yerkes, Bridges, Hardwick, pp. 139-159.

of two per second. If S. fails, give him the three digits of the second column. Succeeding in the first or second trial, he is allowed one point credit. If he fails twice no credit is allowed. Discontinue the test if a subject fails in both trials for any given number of digits. The same rule regarding credit holds for each one of the six lines. One point credit is allowed for each number of digits from three to eight inclusive, making a total possible credit of six points for this test. Mark each trial plus or minus as it is made.

5. *Comparison of 4 and 6 cm. sticks, and 6 and 15 gm. and 9 and 18 gm. weights.* (a) The subject is asked to hold his hands to receive what E. puts into them. E. then places the 4 and 6 cm. sticks, one in each of his hands, saying to him, "Give me the long stick." E. then takes the sticks and repeats the experiment, with the long stick in the other hand. One point credit is allowed when correct judgments are given in both trials. Hesitation constitutes failure. The blind subject, however, may be allowed to place the sticks side by side in his hands.

(b) and (c) Use the Stoelting cubes of the weights designated, putting the 6 and 15 gm. weights into S's hands. Say to him, "Give me the heavier." If he does this successfully, repeat, putting the heavier weight in the other hand. If both trials are correct he is allowed a credit of one point. If either judgment is wrong, no credit is allowed. Proceed in the same way, and make credit allowance by the same rule, with the 9 and 18 gm. weights.

6. *Adaptation Board.* This board is one-half inch thick and measures 22 x 28 cm. There are four round holes in the board. The centers of these holes are 55 mm. from the sides and 70 mm. from the ends of the board. Three of the holes are of a diameter of 62 mm. each. The fourth hole has a diameter of 65 mm. The board is finished with shellac and wax, and the two sides are indistinguishable by touch or vision. A circular block one inch thick and 65 mm. in diameter, fits easily into the large hole, but will not enter any of the other three. Pintner's directions, which we follow, are these;

The board is held before S., in the air, at an angle of 45 degrees to the table, with the side of the board horizontal, and with

the large hole in the upper left corner to S. S. is asked to feel of the board and tell E. what he finds. The fact must be brought out that there are four round holes. The round block is then given to him. As he takes it into his preferred hand, he is told that the block will fit into only one of these four holes. He is asked to find which one it will go into. If he finds which one it will go into before he has tried each one of the four holes, ask him to make sure that it will go into no hole other than the upper left. When this is proved to his satisfaction, he is asked to hold the block in his hand and is told that E. is going to turn the board over and he must attend closely to find how it moves. This the blind subject will naturally do by keeping his free hand upon the board. The board is turned very slowly (use two to three seconds of time for this turning movement) so that the large hole comes into the upper right corner of the board. Rotate left end of board toward S. This is position *one*. E. now says to the subject, "Put the block into the only hole that it will enter." Note on the record blank which hole he tried first, second, and third, and so on until success is attained. If it is placed directly in the upper right hole, simply record (1) u. r. *1.* which means Position *one:* upper right, first trial. One point credit is allowed for unhesitatingly placing the block in the upper right hole. No credit for any result less perfect. E. next turns the board over so that the large hole is in the lower right corner of the board, with similar instructions to S. to attend, and with the same slow movement. Rotate upper edge of board toward S. This is position *two*. S. is then asked to put the block into the only hole into which it will enter. One point credit is allowed for prompt and accurate placing of the block. Total credit, two points.

Note:—A third movement by which the large hole is brought into the lower left corner of the board, and a fourth, by which the large hole is changed from the lower left to upper right corner, result in *third* and *fourth* positions, which are recommended to be used in this test. Proposed scoring: two points credit for all four correct, and one point credit for any three correct, allowing for missing position *one* from lack of training, or

position *four* because of the inherent difficulty in following rotation of the board upon its diagonal.

7. *Resisting suggestions.* The five cubes, one 15 mm., one 22 mm., one 29 mm., and two 36 mm., constitute the material for this test, and seem to be satisfactory substitutes for Binet's lines, which vary from 4 cm. to 7 cm. The procedure is as follows: Having S. hold his hands to receive whatever E. will put into them, E. places simultaneously the 15 mm. cube in S.'s left hand, and the 22 mm. in his right, saying to him, "Give me the big cube." Next E. places simultaneously in S.'s left hand the 22 mm. cube, and in his right, the 29 mm. cube, asking him to hand over the big cube. Next E. places simultaneously the 29 mm. cube in S.'s left hand and one 36 mm. cube in the right, with the same request," Give me the big cube." Next, without a change in the method or change of voice, E. places one 36 mm. cube in each of S.'s hands. Likewise this is repeated two more times, with due shifting of blocks, simulating the sounds and time intervals of an actual change of blocks. It is best to alternate the large cubes (36 mm.) between the two hands. There may be a slight difference in weight, and possibly a difference in temperature. Credit is allowed, as for the lines. The subject is credited with *resisting the suggestions* in each one of the fourth, fifth, and sixth trials when he hands back the cube in his left hand as the largest, and when he says, "They are just the same." One point credit is allowed for each one of these three trials when he gives either "equal" or "left larger."

8. *Defines chair, horse, fork, baby.* Say to the subject, "What is a chair?" Write on the blank exactly what he says. Likewise, with the other three words. Credit is allowed as follows: One point for each definition given in terms of use, as characteristic of a six-year old (Binet). Definitions in terms superior to those of use are credited two points each (Binet, IX yrs.). A typical definition in terms of use is: "A chair is to sit on". Definitions in terms superior to those of use are: (a) Those giving the class to which the object belongs, in addition to use; for example, "A chair is a piece of furniture to sit on"; "A horse is an animal to pull heavy loads." (b) Definitions which give the class to which

the object belongs, as, for example, "A fork is a table utensil," or "A piece of cutlery." (c) Definitions which use the word "thing" or "something" with a statement of the use, as for example, "A horse is a thing to pull heavy loads," or "A fork is something to eat with." (d) Definitions which give both a description in terms of parts or structure of the object, and its use, as for example, "A horse has two ears, four legs," etc., with a statement that "It is to ride upon and to pull wagons."

9. *Choosing the nicer feeling. Aesthetic choices between tactual impressions.* The material for this test consists of pieces of serge, silk, velvet, and Brussels carpet. These pieces are all 3 x 5 inches, and dyed black, in order that there shall be no visual differences. The subject is asked to place his hands ready to receive what E. shall put into them. The serge and silk are simultaneously placed one in each of S.'s hands and he is asked, "Which of these feels the nicer." When he has made his choice the same is repeated, the silk being placed in the other hand. He is given one point credit if both choices are correct. Silk is preferred. Two trials, alternating the hands, are given in like manner with velvet and serge, and carpet and velvet. Velvet is preferred to serge and to carpet. One point credit is allowed for each choice made without hesitation two times out in alternating hands. Total possible credits for the test, three.

10. (a) *Shows examiner's right hand.* As explained above, the examiner seats himself facing S. as he is sitting, with his knees about six inches from S.'s knees, and with his hands upon his own knees. E. then tells S. how he is sitting and where his hands are placed, and tells S. he is going to ask him to do something,—that he wishes him to do it after thinking, so he will be sure that he is doing it right. He then says to S.: "What I want you to do is this: please touch my right hand," and after about three seconds, says, "Now" or "All right." After this is done he says, "Now will you touch my left hand." This latter is merely a confirmation of S.'s knowledge of the position of E.'s right hand, if that was done correctly. A credit of two points is allowed if both right and left hands are touched correctly [illegible] credit for results less perfect than the

(b) *Orientation in respect to points of the compass.* Have S. stand up and face him to the north, either by reference to the table or by gently taking him by the shoulders and turning him so that he faces the north. Tell him then that he is facing north, and ask him to point to the east, then to the the west, and then to the south. Record his answers by drawing on the record blank a square; label it north, and draw three arrows indicating, mapwise, where he points for these other three cardinal points of the compass. Then face S. to the east; tell him he is facing east, and ask him to point in succession to the north, south, and west. Record on another square marked east, how he points to the other three cardinal points. One point credit is allowed for the correct pointing of all three remaining cardinal points when S. faces north. Likewise one point credit for the correct pointing to the remaining cardinal points as he faces east. Total possible credits, two points. No credit for less perfect results when facing north or facing east.

11. *Giving words for three minutes.* Say to the subject, "I want you to say as many words as you can in three minutes. It does not make any difference what the words are. When I say ready you begin and say as many words as you can before I tell you to stop. Say such words as pin, table, grass, trees, clouds, horse, dog, brook. Already, begin." With this, E. having paper and pencil in hand and stop watch ready, starts the watch and begins to write the words S. says. It is very desirable to record all the words which he says, as the free associations thus obtained afford a cross section view of S.'s mental furniture. However, when they come too rapidly, dashes may stand for words in order to record the count. Watch the time and record by half minutes. If S.'s attention lags and he says no word for twenty seconds, he should be encouraged. Ask him to go on, and assure him he knows many more words. Credit is given for words and phrases, except repetitions, as follows: one point for from thirty to forty-four, inclusive; two points, for forty-five to fifty-nine, inclusive; three points, for from seventy-four to seventy-five; and four points, for seventy-five words and upward.

12. *Differences between common objects.* Say to the subject, "You know what an apple is, and you know what a banana is," with a rising inflection in your voice, and if no sign of negation or ignorance is given, continue, "Will you please tell me the differences between apple and banana?" Record S.'s words. If he does not give two clear differences, ask him if there is any other difference. Proceed in the same way with "wood and glass", and with paper and cloth." Credit of one point is given for one correct point of difference in the case of each pair of objects, and two points for two or more differences in the case of each pair. Total possible credits, six.

13. *Knox's lines by finger tapping.* For this test E. sits opposite S., without intervening table, and has S. place his left hand (if he is right handed) in his lap, or upon his thigh, in an easy position with the palm upward. It is desirable to have the fingers fairly well extended and held comfortably well apart from one another, but no muscles must be put upon strain. Let the position be comfortable to S. E. tells S. that he is about to touch his finger tips with a rubber tipped pencil. With this he gives him illustration of the tactual impressions. Gentle but decided impressions are made, separated by time intervals of from one-half to three-fourths of a second. S. is told that the pencil is to be put into his own right hand and that he is to be asked to make the same touches on his left hand as E. has made. With this he is given a lesson in holding the pencil, rubber tip downward, between his thumb and fore-finger. With these illustrations of the kind of tactual impressions to be given and the method of holding the pencil, E. then proceeds to tap out line A, which is 1-2-3-4. E. touches in succession with the rubber tip of the pencil, at time intervals of from one-half to three-fourths of a second, the palmar surface of the distal joint of the fore-finger, of the middle finger, of the ring finger, and of the little finger, having asked E. to give careful attention to what is being done. He then puts the pencil into S.'s hand and asks him to do the same thing. The word *series* is not used in these instructions, and no verbal hint is conveyed that the order of the touches is the important thing. If S. fails to give line A correctly, it

is repeated and continued again and again until he succeeds in giving it correctly. In like manner E. proceeds to give lines X, Y, B, C, D, and so on. One trial only is allowed for each line after A. Credit is allowed for each line, correctly given, from X to G inclusive. The lines are as follows:

A. 1—2—3—4.	B. 1—3—2—4.	E. 1—3—2—4—3.	H. 1—4—3—1—2—4.
X. 1—2—3—4—3.	C. 1—4—3—2.	F. 1—4—3—2—4.	I. 1—3—2—4—1—3.
Y. 1—2—3—4—2.	D. 1—4—2—3.	G. 1—3—1—2—4.	J. 1—4—2—3—4—1.

Note:—It is desirable to give lines H, I, and J and record results. The Knox lines themselves afford a means of scaling intelligence, and the limits of capacity should be reached for each subject tested.

14. *Counting backward from 20 to 1.* Simply say to the subject, "Will you please count backward from 20 to 1." If there is hesitation on his part, say, "20, 19," with a rising inflection of the voice. Record omissions and transpositions, and the time used. We have allowed a credit of two points for correct counting. Where one omission or transposition is made one point credit is allowed. For less perfect results no credit is allowed. Four points credit as allowed by Yerkes and Bridges seems very high valuation for this performance.

15. *Reversing series of digits.* Terman follows Binet's digit series procedure in this test, allowing three trials. He gives credit for any one of the three trials which is correct. For instance, if, in reversing the series of three digits, S. fails on the first and second, but succeeds on the third trial he receives one point credit as he would have done had he succeeded on the first or the second trial. We adopt this procedure. S. should be given an illustration of reversing a series of digits before the first trial of three digits. The numbers should be spoken very slowly, one per second. Mark each trial plus or minus as it is completed. Proceed no further with a given number of digits when success is attained,—that is, if he reverses correctly the first series of three digits, score the credit and proceed to a series of four. When he fails on three trials in a series of digits, proceed no further with the test. Credit one point for each number of digits, three to six, inclusive, which is successfully reversed on

any one of three trials each. Total possible credits four points.

16. *Comprehension test.* Questions:

(a) "If you were going away and missed your train, what would you do?"

(b) "If someone has been unkind to you and says he is sorry, what should you do?"

(c) "Why should you judge a person by what he does rather than by what he says?"

(d) "Why do we more readily forgive an unkind act done in anger than one done without anger?"

Read to S. each question twice, unless he is evidently ready to answer upon hearing it once. Read slowly and distinctly. Record on the blank the subject's own words in answer to each. If in doubt as to whether S. *comprehends* the question, one may ask for further explanation, being careful not to ask leading questions. Satisfactory replies are as follows; (a) "wait for the next" or "take an electric car"; (b) "forgive him" or "pardon him"; (c) "because one is more sure of acts than of words" or "because one may lie in what he says, but you're sure of what he does"; (d) "an angry person is not responsible or does not realize what he does" or "an act done in anger is not intentional." For these, or answers expressing like ideas, full credit of two points for each question is allowed. For less comprehensive and intelligent answers, such as (a) "go home"; (b) "be kind to him" or "do nothing" (c) "actions speak louder than words," partial credit of one point for each question is allowed.

17. *Composing sentence containing three given words.* Write on the back of the record blank the three words which you wish S. to incorporate in one sentence, and mention the words to him, telling him that you wish him to make a sentence, using correctly these three words. Make clear by repetition both the fact that the words are to be used in *one* sentence, and what the words themselves are. It is necessary to emphasize the point that the three words are to be used along with other words to make one good sentence. It is important, especially in institutional work, to vary the words from subject to subject, and from day to day.

Binet observed that this is a test which is very likely to be talked about by children, and consequently many children come with a sentence prepared. Write down on the record blank the sentence or sentences which S. gives, and the time occupied for the completion of the sentence after the task has been set. Credit of four points is allowed for one sentence correctly using the three words given. Two points credit are allowed for the three words correctly used in two sentences. Disjointed ideas connected by "and" are to be rated as two or more sentences.

18. *Arranging Weights.* This is the Binet test. The material used consists of the five 22 mm. Stoelting cubes of weights 6, 9, 12, 15 and 18 gms. The test may be presented to the blind subject very much as to one who sees, the only points of special procedure to be emphasized being these: the cubes are set down on the table and S.'s right hand is placed upon them. E. then takes hold of S.'s left hand, and using his fore-finger as a pointer shows him where to put the weights. His instructions to S. should be these, "Here are five cubes. No two of these cubes weigh the same. They are of exactly the same size, but of different weights. I want you to find the heaviest one and place it here." With this the finger is pointed to a place on the table to S.'s left. Continuing, "Then I want you to find the one just lighter than that and place it here." Point with S.'s finger just to the right of the place designated for the heaviest. Continuing, point to three places further and further to the right, telling him to put here the one lighter than that, and here the one lighter than that, and, to the extreme right, the lightest of all. Write down any such absurd procedure as weighing two or more cubes in one hand at one time. Record time and order of arrangement. If the arrangement is correct, he is credited with two points; if the arrangement is not correct, he is asked to do the same again. If the second trial is correct, two points credit are allowed. If one and only one weight is misplaced in either trial, he is allowed one point credit. No credit is allowed for a performance inferior to this.

19. *Absurdities.* The following five absurd statements constitute the material for this test:

(a) "An unlucky bicycle rider fell on his head and was instantly killed; they took him to the hospital and fear that he can not get well."

(b) "A little boy said, 'I have three brothers, Paul, Ernest, and myself'."

(c) "A gentleman once said, 'If in a moment of despair I should commit suicide, I am going to be careful not to do it on Friday for that would bring me bad luck.'"

(d) "The police have found the body of a young girl cut into eighteen pieces. They think she killed herself."

(e) "It has been found that the last car of a train is damaged most in case of accident. It would be better, therefore, to leave off the last car."

The examiner should say to the subject, "I am going to read some sentences to you. In each one of them there is something foolish or absurd. Please listen carefully and tell me what is foolish in each one of them." E. should then repeat (a) slowly. Read it to S. two times, and ask him, "What is foolish in that?" Of course, if S. starts to answer at the end of the first statement do not insist upon second reading. So in turn each of the five absurdities should be presented. Record exactly, on the blank, S.'s response to each question, "What is foolish in that?" As in comprehension tests, further questions to satisfy E. whether or not S. understands what is absurd, may be asked, providing E. is careful not to ask leading questions. Credit of one point is given for each absurdity discovered. No partial credits allowed.

20. *Definitions of abstract terms.* The three abstract terms (a) charity, (b) obedience, and (c) justice, are used. The examiner should say simply, "What does charity mean?" and after recording the response, "What does obedience mean?" and so on. The definition of charity should express two ideas, that of unfortunates and of kindness shown to them. If the subject replies "love," ask him "What sort of love?" or "to whom is the love shown?" The definition of obedience should be "to do what you are told," or something similar. If the subject says "to obey," ask him what obey means. The definition of justice should express the idea of persons being treated according to

their merits, of fairness, or of protection accorded to people and their interests. If the subject replies "justice of the peace" or names an individual, he should be told that that is not the kind of justice meant and should be given another trial. For an acceptable response, as above defined, credit of two points is given in the case of each of the three terms: no partial credits are allowed.

21. *Analogies.* Begin this test by saying to the subject, "If I say to you, 'Ship is to water as train is to something else', what do you say that something else is?" Then repeat: "Ship is related to water as train is related to what?" If he does not comprehend, ask him what a ship is made for, and when he gets the idea that a ship runs upon water, ask him what a train runs upon. When he answers: "Track, railroad, or rails," put another question, "Man is related to boy as woman is related to what?" And then, "Seeing is to the eye as hearing is to what?" By means of these explanations illustrate to him that the fourth term is related to the third term as the second is to the first, and repeat one of the illustrations backward. For example, "Girl is related to woman in the same way as boy is related to man. Find out the relation between the first and second, and then carry that over to the third and find your fourth term. Now please answer these for yourself." Give him the three terms of each of the six analogies, as follows:

(a) "Oyster is to shell as banana is to" (skin, peeling).

(b) "Arm is to elbow as leg is to" (knee).

(c) "Head is to hat as hand is to" (glove, mitten).

(d) "Truth is to falsehood as straight line is to" (crooked line).

(e) "Storm is to calm as war is to" (peace).

(f) "Known is to unknown as present is to" (future or absent).

Correct answers are given in parentheses. Record his answers in full. One point credit allowed for each analogy correctly completed.

22. *Disarranged sentences.* Put before the subject a strip of paper upon which is printed in New York Point or Braille, all in

small letters, and without punctuation, but with the words duly separated:

"to asked paper my I teacher correct the"

Have him read the words and pronounce them aloud. Then say to him, "You notice these words do not make any sense. They can, however, be arranged in order to make good sense. Arrange them in your mind so that they make a good sentence. Use every word there once. Use no word that is not there. Speak the sentence to me as soon as you are ready." Repeat the words in the order read and observe the time. So present the other two disarranged sentences:

"defends a his dog master good bravely,"

"hour for we early at park an started the."

Record what he says and the time required. The blind subject may require more than the standard sixty seconds allowed the seeing subject. Score two points credit for each one of the disarranged sentences given in the proper order within 60 seconds from the time the task is clearly before him. The most natural forms for the sentences follow: (a) "I asked the teacher to correct my paper"; (b) "A good dog defends his master bravely"; (c) "We started for the park at an early hour." For each of these sentences, credit of two points is allowed; but credit should be allowed also for other sentences, which, although not as natural to the adult as the above, still make perfect sense and are unquestionably, from the childish standpoint, perfectly satisfactory. Such, for example, are: under (a), "I asked my teacher to correct the paper"; under (b), "A master defends his good dog bravely" or "A good master defends his dog bravely"; under (c), "We started early for an hour at the park" or "We started for the park at an hour early." For such sentences full credit should be allowed, and for any others including all of the words so arranged as to make sense and to convince the examiner that the child both understands his task and is able to meet all requirements except those of conventional form and elegance of expression.

III

Point Scale Rating of the Intelligence of the Blind

Standardizing Tests

For the practical purposes of standardizing a scale for the measurement of the intelligence of the blind, in recognition of the fact that we were working with a population among whom every one granted, there is a considerable number of feeble-minded and subnormal persons, it seemed essential to eliminate the results of the definitely feeble-minded persons. Further, in standardizing tests for the blind, we recognized the importance of eliminating records of those who were not blind. (1) In this school population of two hundred and twenty-four persons, a large number had vision sufficient to enable them to perform the tests devised for seeing subjects. Such persons were tested by the Yerkes-Bridges Point Scale. (2) Another group of subjects had insufficient vision for the general tests, yet they were able to see the black cubes upon white paper, and could thus take the Knox Line Tests in the usual way. Such persons have vision sufficient to guide them in going about. It is evident the mental processes involved in their orientation must be quite different from those of totally blind subjects.

Visual imagery with such a subject plays an important part. Poor as his vision is, his visual imagery, nevertheless, serves in some measure in that large synthetic capacity in which it serves the normal seeing subject as he puts together the smaller bits of his experience. For this reason such a subject can not be classed as a blind person for the purpose of standardizing tests for the blind. At any rate, we must first prove, as the result of tests upon large numbers of such subjects, that their mental imagery is in no wise different from that of the totally blind subject. The psychological presumption must be that their mental furniture is different from that of the totally blind, until the opposite is proved.

(3) The same caution, from the point of view of psychology, must be exercised with regard to a small group of subjects whose vision was normal until late childhood. A person whose vision has been annihilated by accident to his eyes, say at six years of age, will undoubtedly retain some visual imagery throughout his life. This visual imagery will serve in the synthetic capacity above referred to, and many of his mental processes will be differently organized from those of a congenitally blind person. Here, too, the presumption of psychology must be that the mental organization of the blind who had his vision up to, say five years, is different from that of the person totally blind from infancy. Results from mental testing of such a person must, therefore, be eliminated while standardizing tests for the blind, until the negative of the above proposition is proved. The limit of five years was set quite arbitrarily. We assume that vision lost earlier than five years, may not have made any significant difference in the mental furniture of the individual, from that of the congenitally blind person. This assumption is purely gratuitous, and it would perhaps be better to set the limit in early infancy. The number of cases of blindness in our subjects occurring after one year of age, and before five, is, however, very small. No one would seriously question the advisability of classifying blind persons who had lost the use of their eyes in early infancy through gonorrhoeal infection, as blind persons. Visual imagery can play a very insignificant rôle in the mental organization of a person whose eyesight was destroyed when he was three months old.

For practical purposes of standardizing tests for the blind, we have, therefore, designated those persons having vision sufficient for the regular tests, *Group 4;* those persons whose vision was sufficient for the Knox Cube test, but not adequate to the regular tests in general, are designated as *Group 3;* those who are totally blind but have lost use of their eyes at or later than five years of age, are designated *Group 2;* those remaining after these eliminations, who are considered totally blind from or soon after birth, are designated as *Group 1.* The subjects of Group 1, are the ones whose results are considered in the standardi-

zation of the Point Scale for the Blind, and in that of individual tests for the blind.

The chronological age of a subject is reckoned as his nearest birthday on the day of examination. For example, a subject is considered ten years old until he passes ten years and six months. If he was born on the 25th of October, 1904, and was examined on the 25th of April, 1915, he would be classed as a 10-year old. If he were examined on the 26th of April, 1915, he would be classed as an 11-year old. He would continue to be classed as an 11-year old up to and including the 25th of April, 1916.

Table I presents the Point Scale scores of all of the one hundred and forty-two blind subjects of Groups 1, 2, and 3, arranged in the chronological age groups of the subjects, and in the order of the points scored, the lowest score for each year appearing first. In this table it is noticed, for example, under age XII that the average attainment for eleven persons tested is 64.4 points, and the median attainment is 64, whereas the lowest score is 23 points, and the next is 37. Considering the average attainment of these eleven persons as a provisional norm for a twelve-year old blind person, we find the co-efficient of intellectual ability of the first to be 0.36, and that of the second, whose score is 37, to be 0.57. With the elimination of these two scores of manifestly inferiorly endowed persons, from the age group, the average would go considerably higher, and their own co-efficients of intellectual ability would go correspondingly lower. Comparing these attainments with the scores in the earlier years, we find only four cases, in the total of thirty-seven VIII, IX, X, and XI-year old subjects, which are lower than 37. One of these is an VIII-year old whose score is 36. The average of five IX-year olds, of whom two are presumably feeble-minded, is exactly 36. The only VII-year old tested made 44 points, and the average of three VIII-year olds is 45.3. In the light of such comparative data alone, it is reasonable to question the integrity of the intelligence of these two XII-year old children. On the other hand, our XIII-year olds (table I), nine in number, average 73.3 points, and the lowest scores 60 points, which, con-

sidering the average for the nine as a provisional norm, gives him a co-efficient of intellectual ability of 0.82.

We can not insist too strongly that these results are from such a limited number of blind persons, that we can not consider that

Ages	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
Scores	44	30	15	41	28	23	60	62	66	42	74	76	65	78	61	66	76	86
		48	24	41	44	37	60	64	71	67	75	81	73	80	73	70	81	
		52	43	44	47	57	64	66	74	79	78	82	76	81	83	93		
			46	44	50	58	69	66	84	80	83	88	78	83	90	97		
			52	49	57	58	73	71	87	86	89	92	85	86	91	98		
				52	59	64	77	72	88	87	92	93	87	91	91			
				56	59	74	83	78	90	89	93	94	87	92	93			
				59	59	81	84	83	91	93	94		90	97				
				60	66	82	90	84	92	96			92	97				
				62	69	87		84					94	98				
				64	70	88		88					98	99				
				65	79			90										
				67	83			91										
				72	87			93										
				73														
Medians	44.0	48.0	43.0	59.0	59.0	61.0	73.0	80.5	87.0	80.0	86.0	88.0	87.0	91.0	90.0	93.0	78.5	86.0
Av. Dev.	—	5.3	11.8	9.0	11.3	16.3	9.0	9.5	7.4	10.8	7.2	5.7	7.6	6.8	8.3	11.8	2.5	—
Averages	44.0	45.3	36.0	56.6	61.2	61.4	73.3	78.0	82.5	79.9	84.7	86.6	84.1	88.5	83.3	84.8	78.5	86.0

TABLE I. Points scored on the Point Scale for the Blind, by the one hundred and forty-two blind subjects of Groups 1, 2, and 3, arranged in the chronological year groups of the subjects, and in the order of points scored, with median and average attainments.

we have valid norms in these median attainments. There is, however, an evident increase year by year from VII to XXIV, with only insignificant exceptions. From VIII to IX, there is a dropping of 5 points, which means either that we have unusually bright VIII-year olds, or unusually dull IX-year olds. As remarked above two IX-year olds are probably feeble-minded. X and XI-year scores both have a median score of 59. This is interesting in relation to the facts (1) that Binet offered no XI-year tests in his 1911 series, and (2) that Yerkes and Bridges find relatively a very small number of points difference between the average attainments of X and XI-year old children of English speaking parents. The falling back about one point at XVI and at XIX and XXI are incidental to the small numbers of scores here assembled. In view of the very small and uncertain steps in development of the varieties of mental ability tested by this scale, from XV-years onward, it is surprising to find such indication of advance as there is in these later adolescent years.

The irregularities of the curve of progress in attainment may be due (1) to the mixed psychology, or different mental processes, of the persons whose scores are here massed; (2) to the presence of the scores of mentally deficient persons in spots in the table; or (3) to the relatively small numbers dealt with in year groups. The first possibility is obviated, by selecting scores of Group 1; the second by selecting from Group 1, the scores of only those persons the integrity of whose mental endowment is above suspicion. These selections are now presented. The third possible source of irregularity can only be corrected by the examination of many more blind.

The Point Scale is new, and fine points of its meaning with respect to the measurement of intelligence have not been worked out. It is a question as to what co-efficient of intellectual ability represents definite mental deficiency. We may consider provisionally that the co-efficient of intellectual ability of 0.75 marks off mental defect. This means one who scores 75 per cent or less of the average for his age group is a defective.

The assembled scores of the subjects blind from birth or early childhood, together with the median attainments of year groups

and averages of the same, do not result in any smoothing up of the curve of progressive attainment. On the contrary, there is a marked increase in irregularity of averages produced by eliminating Groups 2 and 3. This probably is the result to be expected from the considerably smaller number of data considered. As argued above, though, this seems to be the procedure demanded by our present knowledge of the psychology of the blind.

Age	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII
Scores	44	52	46	44	47	37	60	78	66	80	74	76	76	78	61	66	76
			52	49	57	58	60	83	74	86	78	81	87	80	73	70	81
				52	59	81	64	90	87	87	83	88	90	81	83	93	
				59	59	87	73	91	88	96	93	92	94	91	90	97	
				62	59	88	77	93	90			94		97	91	98	
				64	69		90							99	93		
				67	83												
				72	87												
				73													
Medians	44.0	52.0	49.0	62.0	59.0	81.0	68.5	90.0	87.0	86.5	80.5	88.0	88.5	86.0	86.5	93.0	78.5
Av. Dev.	—	—	3.0	8.0	9.5	11.0	9.2	4.4	7.8	4.2	6.0	5.8	5.2	8.0	9.5	11.8	2.5
Averages	44.0	52.0	49.0	60.2	65.0	70.2	70.7	87.0	81.0	87.2	82.0	86.2	86.7	87.7	81.8	84.8	78.5

TABLE II. Scores of seventy-eight subjects of group 1, arranged in year groups and in order of scores, with medians and averages.

Some vision, and early vision leaving vestigial visual imagery, are factors which can be expected to make great differences in the mental organization. In the curve of averages we have most of the drops in the late adolescent years, after 16. We present these results that each investigator may have the full data of Group 1 at his disposal, and form his own judgment as to the reasonableness of our principles of selection of the normal subjects of the group.

Table III presents in the same manner as tables I and II the

Age	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII
Scores	44	52	46	52	59	81	64	78	87	86	83	81	90	91	90	93
			52	59	59	87	73	83	88	87	93	88	94	97	91	97
				62	59	88	77	90	90	96		92		99	93	98
				64	69		90	91				94				
				67	83			93								
				72	87											
				73												
Medians	44.0	52.0	49.0	64.0	64.0	87.0	75.0	90.0	88.0	87.0	88.0	90.0	92.0	97.0	91.0	97.0
Av. Dev.	—	—	3.0	7.0	10.3	2.3	7.5	4.4	1.0	3.3	5.0	4.2	2.0	2.6	1.0	1.6
Averages	44.0	52.0	49.0	64.1	69.3	85.3	76.0	87.0	88.5	89.7	88.0	88.7	92.0	95.7	91.3	96.0

TABLE III. Scores of the fifty-two subjects of Group 1 (blind from birth or from earlier than five years of age) after the elimination of the feeble-minded and subnormal, with medians and averages.

points scored on the Point Scale for the Blind by the fifty-two normal subjects of Group 1. Those upon whom there is general agreement of mental defect, have been eliminated. This cutting-down of the number of subjects presents very small numbers for averaging. The regularity of the progression, which is manifested, is surprising, in view of the very small numbers in year groups. We find only four points in the curve wherein these averages are plotted in Figure 1, where a recession is manifest. This curve is the solid line. The first recession is at IX years, the one subject at VIII scoring 52 points. At IX, two subjects average 49 points. At X, the median and average of seven subjects are 64 points. The probabilities are strong that we have an exceptionally bright VIII-year old. Again, the XIII-year average recedes nine points from the XII-year average, and the median, twelve points. The XII-year results are a remarkable advance upon those of XI-years. The three XII-year olds, whose results are here averaged, are all unusually intelligent persons. The recessions at XVII and XXI-years are not very significant. They are small in amount and the progress in the development of intelligence beyond XVI-years is very slight as compared with such progress between VII and XIV. Recognizing that IX and XIII are low and XII is high, we have a fairly trustworthy guide of the attainments to be expected of normal blind children from VII to XV-years in the average attainments presented in Table III.

Figure 1 presents the graphs of (1) the average attainments by year groups, of the one hundred and forty-two blind subjects of Groups 1, 2, and 3 (dotted line), (2) averages for the seventy-eight subjects of Group 1 (dash and dot line), and (3) averages of the fifty-two normal subjects of Group 1 (solid line).

For practical purposes and from the combined results of point scale and year scale examinations, there seemed no reasonable doubt as to the subnormality of any one of the twenty-six subjects of Group 1, whose score has been omitted from table III. From the other groups resulting from classification by vision, we eliminated large numbers as being subnormal in mentality. Of the eighty-two with vision sufficient for the regular tests,

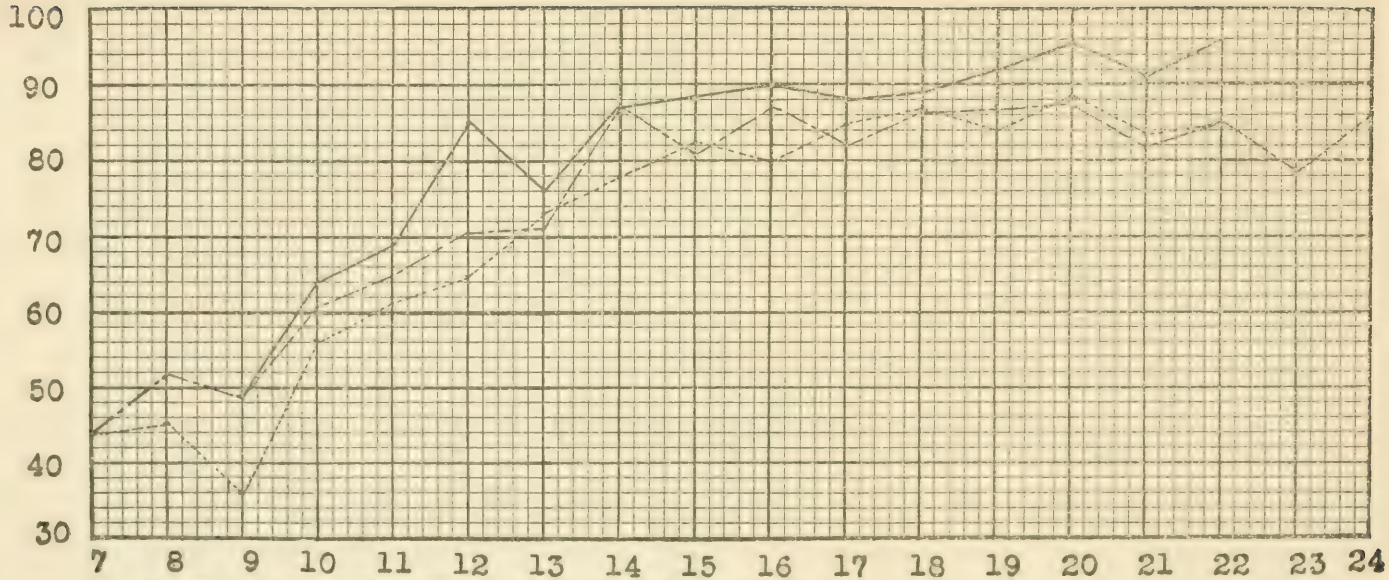

FIGURE 1. *Average* of scores for year groups of blind subjects.

(1) Dotted line (.....) averages of one hundred and forty-two subjects of Groups 1, 2, and 3.

(2) Dash and dot line (—·—·—·) averages of seventy-eight subjects of Group 1.

(3) Solid line (———) averages of fifty-two normal subjects of Group 1.

Ordinates = points scored; abscissae = chronological ages in years.

we classed thirty-three as subnormal. Of the forty-one with vision sufficient for some orientation (seeing blocks) we classed nineteen as subnormal. Of the nineteen blind persons who have lost sight since early childhood, four were classed as subnormal. In all of the two hundred and twenty-four blind persons examined, eighty-two, or 36.6 per cent were rated as subnormal. Twenty-one of these eighty-two were considered definitely feeble-minded. A few examples taken at random will illustrate how these classifications were made.

The lowest rating found among the XII-year olds of Table II is that of a boy of 11 years and 11 months. His Point Scale score is 37 points. This is a lower attainment than that of any single one of the twenty-one younger subjects of this group. His co-efficient of mental ability is 0.53 if the average for the five of the year group is taken as the norm, and 0.46 if the median attainment in this group is accepted as the norm. By the year scale this subject passed sufficient Binet VI-year tests to warrant considering six his basal year. Above this he counted thirteen pennies, got the size-weight illusion, managed the adaptation board, counted from 20 to 1, gave days of the week, and months of the year, repeated three digits backward, gave similarities of two things (3 of 5), and resisted suggestions (cubes). He did not know right and left, could not repeat five digits, failed on VIII-year comprehension tests, did not arrange weights, or know the date, got only one of the Knox lines (X), could not use three words in a sentence, or explain absurdities. These failures put him somewhat under VIII-years in mental development, and he is classed as feeble-minded.

The next highest score among the XII-year olds of Table II is 58 points attained by a girl of 11 years and 7 months. This gives a co-efficient of mental ability of 0.83 by the average of the group, and 0.72 by the median. She failed in the absurdities; in the comprehension tests; gave only forty-three words in three minutes; did not compose a sentence with three given words; failed to arrange any sentence; did not arrange weights or define abstract terms; and gave only one analogy. Judged by Binet

standards her limit is found at X-years, and she is one and a half years retarded. She is therefore classed as subnormal.

The lowest score in the X-year group, Table II, is 44, that of a boy of 9 years and 10 months. From the average of the group he has a co-efficient of mental ability of 0.73. This boy passed Binet VII-year tests, but failed to count backward from 20 to 1; he did not arrange weights; could not give similarities of two things; could not repeat six digits, or give four digits backwards; could not make a sentence using three given words, or give rhymes, or see absurdities, or arrange sentences; and he gave only thirty-four words in three minutes. He is therefore slightly under a IX-year level, and is retarded about a year. This boy has a brother and a sister in the school. They are all slow and subnormal.

A boy of 16 years and 11 months made a score of 78. This is close to the average for his age. He was unable to touch examiner's right hand, and uncertain of relations of points of the compass. He did not make a sentence using three given words. He could not give similarities of three things; he could not solve problems of fact, or give differences between president and king, or between abstract terms. He has a marked hydrocephaly. He is subnormal.

A young man of 20 years and 9 months scored 61 points. His co-efficient of mental ability by the median attainment of XXI-year olds is 0.70. He gave 55 words in three minutes. He could not repeat seven digits, or reverse five. He could not repeat twenty-two syllables. He failed on absurdities, and on comprehension tests. He got only one analogy, and failed to compose or arrange sentences. In fact he lacks the machinery for thinking. Has a mental age of ten years. He is feeble-minded.

A young woman of 22 years and 1 month, made a score of 66 points. Her co-efficient of mental ability by the average for the year group is 0.78. She gave fifty-three words in three minutes. She could not repeat seven digits or reverse five, gave only X and Y of the Knox lines, failed on the XI-year comprehension test; failed on orientation tests; failed to arrange weights; and

completed only one analogy. Her mentality is that of one about 10½ years old. She is feeble-minded.

A young woman of 22 years and 7 months scored 76 points. She could not make a sentence using three given words. She gave only thirty-eight words in three minutes; she saw only two of five absurdities; she could not repeat seven digits; she failed to resist suggestions and she could not solve the problems of fact. She is a peculiar and definitely limited personality. Subnormal best designates her mentality.

These data make clear the grounds upon which this division of the subnormals was made. It is, however, a grave question to what extent, if any, these subnormals should be eliminated for standardization of tests. While there can be no question, as stated above, that this population is loaded above the average with feeble-minded, there is, on the other hand, no doubt the subnormals who are not definitely feeble-minded should be allowed to counterbalance the exceptionally well endowed, in computing averages and medians.

In order to approach this question with good vision we may cut across each year group at 25 per cent above and 25 per cent below the average for that year group. This will afford some insight into how much our groups are over-weighted with defectives. Calculation of these 25 per cent values above and below the average for each year group of Table II reveals four scores below and four above these limits. Forty-four in X, 47 in XI, 37 in XII, and 61 in XXI are those below the limits of 25 per cent less than averages. All other scores of Table II, eliminated in Table III, are inside of this 25 per cent limit. Eighty-three and 87 in XI, 88 in XII, and 90 in XIII are above the limit of 25 per cent more than averages. The numbers of cases above and below, are therefore, the same,—four in each case. The aggregate amount of departure from the limit is, however, much greater in the lower scores. By this showing we have no great overloading with feeble-minded in the group of blind subjects, and since the curve of averages for the total seventy-eight subjects of Group 1 presents a more even curve of progress in attainment, up to fourteen years, it seems we have in the average

attainments of these seventy-eight, more reliable provisional norms than in those of the selected fifty-two of Table III. We proceed, therefore, to present the data from all of the seventy-eight subjects of Group 1. These data are so presented, however, that anyone who wishes may eliminate the feeble-minded and subnormal from his consideration.

IV

Detail of Achievement of the Blind by the Point Scale

In order that this work may be put most conveniently at the service of other workers in this field, and may be made the basis of further standardization of this point scale or of any of the tests used herein, we present herewith, in Table IV, the scores of each one of the seventy-eight blind subjects, in the order of chronological ages, for each one of the twenty-two tests described above. The subjects considered subnormal for purposes of practical classification are designated by letters in the column before the year of age. Others are designated by numbers. From the total scores and the ages given, Tables II and III, may be reconstructed.

	Yrs.	Mo.	Sex	Gr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Totals
1.	VII	3	M.	I	1	2	4	3	3	1	2	6	3	2	1	6	0	0	0	4	0	2	1	0	3	0	44
2.	VIII	4	F.	II	2	0	6	6	3	0	3	6	3	4	2	4	3	2	1	3	0	0	1	2	1	0	52
3.	VIII	7	M.	II	1	2	2	3	3	1	3	8	3	3	2	6	2	2	2	2	0	2	2	0	3	0	52
4.	IX	0	M.	I	2	0	4	4	3	0	0	8	2	4	0	3	4	1	3	2	0	2	1	1	2	0	46
5.	IX	7	M.	II	2	2	4	4	3	2	3	8	3	1	3	5	6	2	3	3	0	2	2	2	2	0	62
6.	IX	7	F.	III	1	2	6	6	3	1	0	8	3	0	2	6	4	2	3	4	2	2	2	0	2	0	59
a.	IX	9	M.	I	1	2	4	3	3	2	3	8	2	0	1	3	5	0	1	4	0	1	0	0	1	0	44
7.	IX	10	M.	II	1	2	4	4	3	2	3	7	3	4	1	4	3	2	2	3	0	2	0	0	2	0	52
8.	IX	10	M.	IV	2	2	6	5	3	1	2	7	3	4	4	6	3	2	2	5	2	2	1	2	4	4	72
b.	X	0	M.	II	2	2	4	3	3	2	3	5	3	2	3	5	2	2	2	2	0	0	1	2	1	0	49
9.	X	1	F.	III	2	2	4	5	3	2	3	7	3	4	3	6	7	2	3	2	0	2	2	0	2	0	64
10.	X	1	F.	III	2	2	6	6	3	2	1	8	3	2	3	5	1	2	4	8	2	2	5	2	4	0	73
11.	X	5	F.	III	2	2	6	5	3	2	3	8	3	3	4	6	3	0	4	6	0	1	1	2	1	2	67
12.	X	6	M.	II	2	2	4	5	3	2	3	8	3	2	4	5	4	2	1	4	0	2	0	0	3	0	59
13.	X	6	F.	II	2	2	4	4	3	2	3	7	3	3	2	6	6	2	1	3	2	2	1	0	1	0	59
c.	X	8	F.	II	2	2	4	4	3	2	3	7	3	4	0	6	2	2	1	6	0	2	0	2	2	0	57
d.	X	10	F.	III	2	2	4	3	3	0	3	6	3	2	2	4	4	2	2	2	0	0	1	0	2	0	47
14.	X	10	F.	IV	2	2	4	5	3	2	3	8	3	4	3	6	5	2	4	6	2	2	4	4	3	6	83
15.	X	11	F.	III	2	2	4	4	3	2	3	7	3	3	1	6	6	2	3	4	2	2	2	2	2	4	69
16.	XI	0	M.	II	1	0	4	6	3	0	3	6	3	4	4	6	3	2	0	4	0	2	4	2	2	0	59
17.	XI	2	M.	IV	1	2	6	5	3	2	2	8	3	4	4	6	6	2	3	7	4	2	4	6	5	2	87
e.	XI	7	F.	III	2	2	4	4	3	2	2	7	3	4	1	6	5	2	3	4	0	0	1	2	1	0	58
18.	XI	8	F.	IV	2	2	4	5	3	2	3	8	3	4	1	6	8	2	4	6	0	2	3	2	5	6	81
f.	XI	11	M.	I	2	2	4	2	2	2	3	7	3	0	1	3	1	2	1	2	0	0	0	0	0	0	37
19.	XI	11	F.	IV	2	2	6	6	3	2	2	8	3	4	4	6	5	2	4	8	4	2	5	4	4	2	88
20.	XII	1	M.	V	2	2	4	6	3	2	3	6	3	2	4	6	8	2	4	6	4	2	5	2	5	6	87
21.	XII	7	M.	IV	2	2	4	6	3	2	1	8	3	2	2	4	5	2	4	4	4	2	1	0	3	0	64
g.	XII	8	M.	III	2	2	4	4	3	2	0	8	3	4	2	5	6	1	0	4	4	2	2	0	2	0	60
22.	XII	8	M.	VI	2	2	6	4	3	2	3	7	3	4	3	6	7	2	4	8	4	2	5	2	5	6	90
23.	XII	9	F.	IV	2	2	6	4	3	0	3	8	3	4	4	6	3	2	1	6	4	2	2	4	6	2	77

TABLE IV. Showing the scores for seventy-eight blind subjects (Group 1), for each one of the twenty-two tests of the Point Scale for the Blind. Also ages in years and months, and school grades of each subject at time of examination.

	Yrs.	Mo.	Sex	Gr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Totals
h.	XIII	0	F.	IV	1	0	6	3	3	2	1	8	3	3	1	6	5	2	3	4	2	1	1	2	3	0	60
24.	XIII	2	M.	V	2	2	4	6	3	2	1	8	3	2	2	6	4	2	0	8	2	2	4	5	1	4	73
25.	XIII	8	M.	IV	2	2	6	6	3	2	2	8	3	4	2	5	6	2	4	6	2	2	3	2	4	2	78
26.	XIII	8	M.	VIII	1	2	6	6	3	1	2	8	3	4	4	6	7	2	2	6	4	2	5	2	3	4	83
27.	XIII	11	F.	VIII	2	2	6	6	3	1	3	8	3	4	4	6	7	2	4	4	4	2	5	6	2	6	90
28.	XIV	1	F.	VII	2	2	6	6	3	1	3	8	3	3	2	6	7	2	3	6	4	2	4	6	6	6	91
29.	XIV	2	F.	V	2	2	6	6	3	2	3	8	3	2	4	6	6	2	4	8	4	1	5	6	6	4	93
30.	XIV	7	F.	VI	2	2	4	4	3	2	3	7	3	4	4	6	8	2	3	8	2	2	4	6	5	4	88
i.	XIV	11	M.	V	2	2	4	2	3	2	3	7	3	4	3	5	6	2	2	4	2	2	5	2	1	0	66
31.	XV	1	F.	VI	2	2	4	6	3	2	3	8	3	3	4	6	5	2	4	8	4	2	4	6	5	4	90
j.	XV	4	M.	V	2	2	4	3	3	2	2	8	3	4	4	6	4	2	1	5	4	2	3	6	2	2	74
32.	XV	4	M.	VII	2	2	4	5	3	2	1	8	3	4	4	5	6	2	3	7	4	2	4	6	4	6	87
k.	XV	10	M.	VI	2	2	4	4	3	2	3	8	3	4	3	6	5	2	3	6	4	2	3	6	1	4	80
33.	XVI	0	M.	VII	2	2	4	5	3	2	3	8	3	4	4	6	6	2	3	6	2	2	5	6	3	6	87
34.	XVI	1	M.	H.S.	2	2	6	6	3	2	3	8	3	4	4	6	6	1	4	8	4	2	5	6	5	6	96
35.	XVI	1	M.	VI	2	2	6	6	3	2	3	8	3	2	2	5	5	2	3	8	4	2	4	6	4	4	86
l.	XVI	10	M.	VII	2	2	4	6	3	0	3	6	3	2	4	5	5	2	2	5	4	2	3	4	3	4	74
m.	XVI	11	M.	VII	2	2	6	6	3	2	3	8	3	1	3	4	6	2	4	6	2	2	3	5	1	4	78
36.	XVII	0	F.	VIII	2	2	6	4	3	0	3	8	3	3	4	6	4	2	4	7	4	2	3	6	3	4	83
37.	XVII	5	M.	H.S.	2	2	4	6	3	2	3	8	3	3	4	6	8	2	4	5	4	2	4	6	6	6	93
38.	XVII	6	M.	H.S.	2	2	6	5	3	2	3	8	3	4	4	6	6	2	3	8	4	1	4	6	4	6	92
39.	XVII	7	F.	H.S.	2	2	6	6	3	2	3	8	3	4	4	6	6	2	4	7	4	2	3	6	5	6	94
40.	XVII	8	M.	VIII	2	2	6	6	3	0	3	8	3	4	4	6	7	2	4	4	2	2	5	6	3	6	88
n.	XVII	9	F.	VII	2	2	4	5	3	2	3	7	3	4	3	6	6	2	3	6	4	2	0	4	1	4	76
41.	XVII	9	F.	VI	2	2	6	6	3	2	1	8	3	3	3	5	6	2	4	5	0	2	3	6	3	6	81
o.	XVIII	9	F.	VII	2	2	4	6	3	2	3	8	3	4	3	4	4	2	2	7	0	2	3	4	2	6	76
42.	XVIII	9	F.	H.S.	2	2	6	4	3	2	3	8	3	4	4	6	6	2	4	8	2	2	3	6	6	4	90
43.	XVIII	9	M.	H.S.	2	2	6	5	3	2	2	8	3	4	4	6	8	2	4	7	4	2	4	6	4	6	94
p.	XIX	2	F.	VIII	2	2	4	6	3	2	2	8	3	4	4	5	6	2	3	6	4	0	5	6	4	6	87
q.	XIX	7	F.	VIII	2	2	4	5	3	1	3	8	3	4	4	5	2	2	4	4	4	1	4	4	3	6	78
44.	XIX	7	M.	H.S.	2	2	6	6	3	2	3	8	3	4	4	6	7	2	4	8	4	2	5	6	6	6	99

Continuation of Table IV.

	Yrs.	Mo.	Sex	Gr.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	Totals
45.	XIX	7	M.	H.S.	2	2	6	6	3	2	1	8	3	3	4	6	4	2	4	8	4	2	5	6	4	6	91
46.	XIX	9	F.	H.S.	2	2	6	5	3	2	3	8	3	4	4	6	6	2	4	8	4	2	5	6	6	6	97
r.	XIX	11	F.	VII	2	2	4	5	3	2	3	7	3	4	2	6	6	2	4	7	4	2	3	4	2	4	81
s.	XX	5	F.	VII	2	2	4	5	3	2	3	7	3	2	4	6	7	2	4	4	4	2	3	4	3	4	80
t.	XX	8	F.	VII	2	2	4	6	3	2	2	8	3	2	1	5	3	2	3	6	4	0	3	6	2	4	73
u.	XX	9	M.	VIII	2	2	4	4	3	2	3	8	3	3	2	5	6	2	2	2	0	2	1	4	1	0	61
v.	XX	9	M.	H.S.	2	2	4	6	3	1	3	5	3	4	0	6	6	2	4	8	4	2	4	6	2	6	83
47.	XX	9	M.	H.S.	2	2	6	6	3	2	2	8	3	2	4	6	4	2	4	8	4	2	5	6	5	4	90
48.	XX	11	M.	H.S.	2	2	4	4	3	2	2	8	3	4	4	6	6	2	4	8	4	2	5	6	4	6	91
49.	XXI	2	M.	H.S.	2	2	6	6	3	2	1	8	3	4	4	6	6	2	3	7	4	2	5	6	5	6	93
50.	XXI	6	F.	H.S.	2	2	6	6	3	2	3	7	3	4	4	6	7	2	4	7	4	2	5	6	6	6	97
w.	XXI	7	F.	VIII	2	2	4	5	3	2	3	8	3	4	1	6	2	2	3	5	0	1	4	6	2	2	70
x.	XXII	1	F.	V.	2	2	4	4	3	2	3	6	3	2	2	5	2	2	2	4	4	0	3	6	1	4	66
51.	XXII	2	F.	H.S.	2	2	6	6	3	2	3	8	3	4	4	5	8	2	4	8	4	2	4	6	6	6	98
52.	XXII	4	F.	H.S.	2	2	6	4	3	2	3	7	3	4	3	6	6	2	4	8	4	2	5	6	5	6	93
y.	XXII	7	F.	H.S.	2	2	4	3	3	2	1	7	3	4	1	6	6	2	4	7	0	2	2	6	3	6	76
z.	XXII	8	F.	VI	2	2	4	6	2	2	3	7	3	2	3	5	5	1	2	7	4	0	5	6	4	6	81

Continuation of Table IV.

V

Changes Recommended in the Point Scale for the Blind. Final Average Scores for Subjects Examined.

1. Changes in Tests.

(1) Change the verbal memory Test 3, in conformity with Yerkes' recommendations as given on page 137 of "A Point Scale for Measuring Mental Ability."

(a) It rains. I am hungry. (1)

(b) His name is John. It is a very fine day. (1)

(c) The sun is very large and red. Our train was more than two hours late. (2)

(d) It is not necessary to hurt the poor little birds. It is night and all the world rests in sleep. (2)

The total of possible credit points remains the same (6).

(2) Change the administration of Test 6. Give all the four *changes* of position according to Pintner's directions. Score *one point* credit when any *three positions* are reacted to by unhesitatingly putting the block into the right hole, and *two points* credit for the same correct placing without hesitation in all *four* of the *changed positions*.

(3) In Test 8 ask for definition of "spoon" instead of "fork." This avoids much hesitation which does not imply ignorance, and the oft recurring question "What kind of a fork?"

(4) In Test 13 give in addition the (d) group of Knox Lines, H, I, and J. Give one point credit for each of these three lines, correctly repeated.

2. Changes in Credits.

(1) In Test 1 give one point credit for correct enumeration of eight objects, and the same when one small object is not named because not found.

(2) In Test 2 give one point credit for two correct responses (handing back the smaller cylinder as heaviest) twice, once from each hand.

(3) In Test 10 (a) give one point credit for correctly touching without hesitation both the right and left hand of the examiner.

(4) In Test 13 give one point for each of the lines H, I, and J correctly repeated.

These changes in credit allowances take off three points where they are too easily attained, putting tests 1, 2, and 10 (a) practically on a level with 5 (a) and the three parts of 9. This seems a reasonable adjustment. For these three points we add three to be obtained for lines H, I, and J. This will tend to bring out more differences in the higher reaches of intelligence development. This is a desideratum of importance.

3. Changes in the order of tests.

With the experience gained from testing these blind persons, some changes in the order of tests seem desirable. The order recommended follows fairly closely the order of average amounts of attainment of the seventy-eight blind subjects. These subjects do not comprise many children of less than ten years of age. Some allowance is made for this fact in determining the order of easier tests. The percentage relation, of the aggregate actual attainment of all the subjects, to the maximum possible attainment, is shown for each of the twenty-two tests in Table V, also the average score of seventy-eight subjects on each test. The

No.	Designation of Test	Possible Score	Average Score	Percentage Attainment
5	Comparison of Sticks and Weights	3	2.97	99.1
9	Choosing the "nicer feeling"	3	2.97	99.1
2	Size-Weight Illusion	2	1.90	94.9
1	Naming Objects in a Box	2	1.88	94.2
8	Definitions, "chair, horse," etc.	8	7.51	93.9
14	Counting backwards from 20 to 1	2	1.87	93.6
12	Differences between common objects	6	5.50	91.6
7	Resisting suggestions	3	2.49	86.6
6	Adaptation Board	2	1.68	83.9
18	Arranging weights	2	1.68	83.9
4	Memory for digits	6	4.91	81.8
3	Repeating sentences	6	4.82	80.3
10	Orientation	4	3.20	80.0
15	Reversing series of digits	4	2.92	73.1
11	Giving words for three minutes	4	2.88	72.1
16	Comprehension	8	5.63	70.4
20	Definitions of abstract terms	6	3.86	64.3
13	Knox Lines by Finger Tapping	8	5.09	63.6
17	Three given words in a sentence	4	2.49	62.2
19	Absurdities	5	3.10	62.1
22	Disarranged sentences	6	3.38	56.4
21	Analogies	6	3.19	53.2

TABLE V. Average scores of seventy-eight blind subjects on twenty-two tests of the Point Scale for the Blind, with the percentage relations of the aggregate scores, on each test, to the total possible scores on the same.

numbers of tests are given as in the Provisional Point Scale for the Blind as we used it.

Recommended order of tests with changed scoring;

1. Choosing twice the "nicer feeling" of two fabrics;
   (a) Serge and silk (1)
   (b) Velvet and serge (1)
   (c) Carpet and velvet (1) (3)
2. Comparing twice
   (a) 4 and 6 cm. sticks. (1)
   (b) 6 and 15 gm. weights. (1)
   (c) 9 and 18 gm. weights. (1) (3)
3. Size-Weight Illusion, twice. (1) (1)
4. Naming seven of eight objects in a box. (1) (1)
5. Counting backwards from 20 to 1. (2)
   One omission or transposition. (1) (2)
6. Defining in terms of use (1 each); superior to use (2 each).
   (a) spoon
   (b) chair
   (c) horse
   (d) baby (8)
7. Giving differences (1 or 2 each).
   Apple and banana
   Wood and glass
   Paper and cloth (6)
8. Adaptation Board. Three changed positions correct (1).
   Four changed positions correct (2).
9. Resisting suggestion of size. (Blocks.) (1 for each of three resistances). (3)
10. Arranging weights, two trials. All correct but one (1). All correct (2). (2)
11. Repeating: (a) It rains. I am hungry. (1)
    (b) His name is John. It is a very fine day. (1)
    (c) The sun is very large and red. Our train was more than two hours late. (2)
    (d) It is not necessary to hurt the poor little birds. It is night and all the world rests in sleep. (2) (6)

12. Repeating digits; (1 of 2 correct).

(a)	374	581	(1)
(b)	2947	6135	(1)
(c)	42871	92736	(1)
(d)	461572	526283	(1)
(e)	2749385	6195847	(1)
(f)	37158264	26149738	(1) (6)

13. Reversing series of digits, (1 of 3 correct).

(a)	283	427	395	(1)
(b)	6528	4937	4293	(1)
(c)	31879	69482	52961	(1)
(d)	358164	174928	813692	(1) (4)

14. Orientation. (a) Touching examiner's right and left hands. (1)
(b) Faced north, point E., W., and S. (1)
(c) Faced east, point N., S., and W. (1) (3)

15. Knox Lines by Finger Tapping. Each line (1)
(a) X Y (c) E F G
(b) B C D (d) H I J (11)

16. Giving words for three minutes: 30-44 (1). 45-59 (2). 60-74 (3). 75 or more (4). Record by half-minutes on back. (4)

17. Comprehending questions. (2 each).
(a) Missed train
(b) Someone unkind
(c) Action vs. words
(d) Forgive easier (8)

18. Defining: (a) Charity (2)
(b) Obedience (2)
(c) Justice (2) (6)

19. Using three given words in a sentence. Write on back. Three words in two (2); three in one (4). (4)

20. Seeing absurdities (1 each).
(a) Finely dressed gentleman
(b) Unlucky bicycle rider
(c) Three brothers
(d) Guide Post
(e) Last car (5)

21. Putting together disarranged sentences (2 each).
    (a) My teacher
    (b) A good dog
    (c) We started (6)
22. Completing analogies (1 each).
    (a) Oyster is to shell as banana is to
    (b) Arm is to elbow as leg is to
    (c) Head is to hat as hand is to
    (d) Truth is to falsehood as straight line is to
    (e) Known is to unknown as present is to
    (f) Storm is to calm as war is to (6)

The changes in scoring recommended in 1, Naming objects, 2, Size-Weight illusion, 6, Adaptation board, 10 (a), Touching examiner's right hand, and 13, Tapping Knox lines, can be effected from data at hand for the seventy-eight subjects of Group 1. These changes in credit for the tests mentioned and the resulting new scores for each subject are indicated in Table VI.

Number of Subject	Old Score	Change in Score Test I	Change in Score Test II	Change in Score Test VI	Change in Score Test X	Change in Score Test XIII	New Score
1.	44	0	—1	0	—1	0	42
2.	52	—1	0	0	—1	0	50
3.	52	0	—1	0	—1	0	50
4.	46	—1	0	0	—1	+1	45
5.	62	—1	—1	—1	0	+1	60
6.	59	0	—1	—1	0	0	57
a.	44	0	—1	0	0	0	43
7.	52	0	—1	0	—1	0	50
8.	72	—1	—1	0	—1	0	69
b.	49	—1	—1	—1	0	0	46
9.	64	—1	—1	0	—1	+1	62
10.	73	—1	—1	—1	0	0	70
11.	67	—1	—1	0	—1	0	64
12.	59	—1	—1	—1	0	0	56
13.	59	—1	—1	0	—1	0	56
c.	57	—1	—1	—1	—1	0	53
d.	47	—1	—1	0	0	0	45
14.	83	—1	—1	—1	—1	0	79

TABLE VI. Designation of the subjects (78) same as in Table V. Shows old scores, changes in credit as recommended for tests 1, 2, 6, 10 and 13, and resulting new scores.

15.	69	—1	—1	—1	—1	0	65
16.	59	0	0	0	—1	0	58
17.	87	0	—1	0	—1	+1	86
e.	58	—1	—1	0	—1	+1	56
18.	81	—1	—1	0	—1	+2	80
f.	37	—1	—1	0	0	0	35
19.	88	—1	—1	0	—1	0	85
20.	87	—1	—1	0	0	+2	87
21.	64	—1	—1	—1	—1	0	60
g.	60	—1	—1	0	—1	+1	58
22.	90	—1	—1	0	—1	+1	88
23.	77	—1	—1	0	—1	0	74
h.	60	0	0	—1	—1	0	58
24.	74	—1	—1	—1	—1	0	70
25.	78	—1	—1	—1	—2	0	73
26.	83	0	—1	—1	—1	+1	81
27.	90	—1	—1	—1	—1	0	86
28.	91	—1	—1	0	—1	0	88
29.	93	—1	—1	—1	—1	+2	91
30.	88	—1	—1	0	—1	+2	87
i.	66	—1	—1	0	—1	+1	64
31.	90	—1	—1	0	—1	0	87
j.	74	—1	—1	0	—1	0	71
32.	87	—1	—1	0	—1	+2	86
k.	80	—1	—1	0	—1	+1	78
33.	87	—1	—1	0	—1	+2	86
34.	96	—1	—1	0	—1	+1	94
35.	86	—1	—1	0	0	0	84
l.	74	—1	—1	0	0	0	72
m.	78	—1	—1	0	0	0	76
36.	83	—1	—1	0	—1	0	80
37.	93	—1	—1	0	—1	+1	91
38	92	—1	—1	—1	—1	0	88
39.	94	—1	—1	0	—1	0	91
40	88	—1	—1	0	—1	0	85
n.	76	—1	—1	—1	—1	0	72
41.	81	—1	—1	—2	—1	+3	79
o.	76	—1	—1	0	—1	+1	74
42.	90	—1	—1	0	—1	0	87
43	94	—1	—1	0	—1	0	91
p.	87	—1	—1	—2	—1	0	82
q.	78	—1	—1	0	—1	0	75
44.	99	—1	—1	0	—1	+1	97
45.	91	—1	—1	0	—1	0	88
46.	97	—1	—1	0	—1	0	94
r.	81	—1	—1	0	—1	0	78
s.	80	—1	—1	0	—1	+1	78
t.	73	—1	—1	—1	—1	0	69
u.	61	—1	—1	—1	—1	0	57
v.	83	—1	—1	0	—1	0	80
47.	90	—1	—1	0	—1	+1	88
48.	91	—1	—1	0	—1	0	88
49.	93	—1	—1	0	—1	+1	91
50.	97	—1	—1	0	—1	+1	95
w.	70	—1	—1	0	—1	0	67
x.	66	—1	—1	—2	—1	0	61
51.	98	—1	—1	0	—1	+2	97
52	93	—1	—1	0	—1	+2	92
y.	76	—1	—1	—1	—1	+1	73
z.	81	—1	—1	0	0	0	79

Continuation of Table VI.

These new scores are arranged by year groups and in the order of attainment, with medians and averages for each year group in Table VII. Figure 2 shows a graph of the averages of these scores by years.

Age	VII	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII
Scores	42	50	45	43	45	35	58	73	64	78	72	72	74	75	57	61	73
			50	46	53	56	58	81	71	84	76	79	82	78	69	67	79
				50	56	80	60	86	86	86	80	85	87	78	80	92	
				57	56	85	70	88	87	94	91	88	91	88	88	95	
				60	58	87	74	91	87			91		94	88	97	
				62	65		88							97	91		
				64	79												
				69	86												
				70													
Medians	42.0	50.0	47.5	60.0	57.0	80.0	65.0	86.0	86.0	85.0	78.0	85.0	84.5	83.0	84.0	92.0	76.0
A. D.	—	—	2.5	8.8	9.7	16.2	7.7	5.0	7.8	4.5	5.7	5.6	5.5	8.0	10.1	12.8	3.0
Averages	42.0	50.0	47.5	57.9	62.2	68.6	68.0	83.8	79.0	85.5	79.7	83.0	83.5	85.0	78.8	82.4	76.0

TABLE VII. Revised Point Scale scores of seventy-eight blind subjects, by year groups, with medians and averages for these groups.

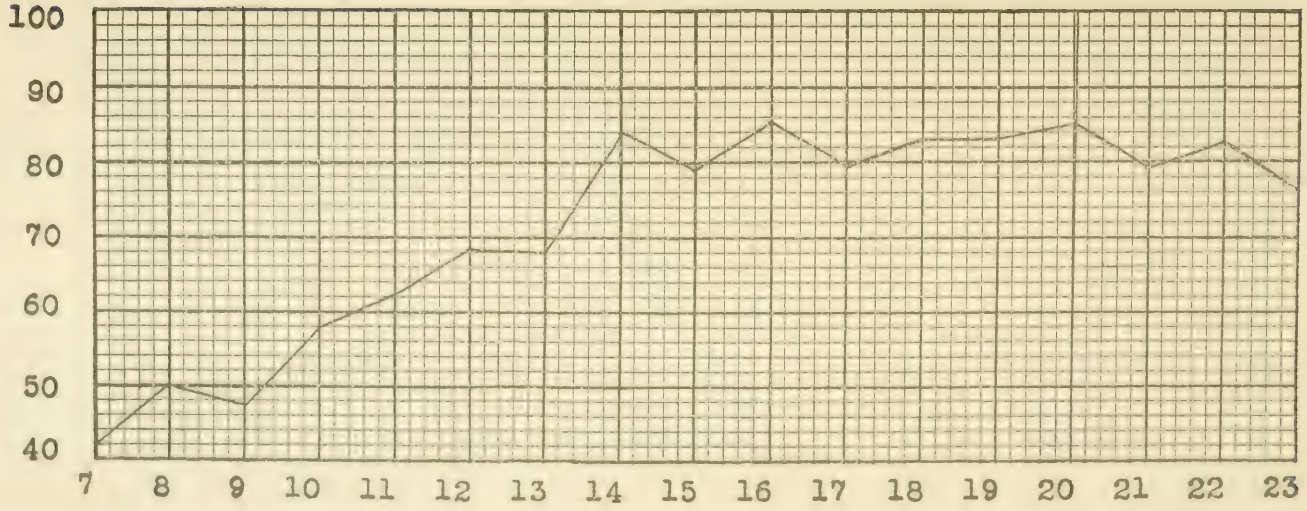

FIGURE 2. Showing the graph of the average scores of year groups of blind subjects (Group 1) from VII to XXIII years, by the revised point scale for the blind.

VI

Point Scale Comparisons of Blind and Seeing Subjects

One of the strong points in favor of a point scale for measuring intelligence is the facility it affords for comparing the mental ability of one social group with that of another. Could we give the same tests to the blind which Yerkes and Bridges applied to the mental measurement of Cambridge school children, we should be able to state the percentage relations, year by year, of the one group to the other, and to see the relative order and rate of development of mental processes. This direct comparison is impossible, but we can compare the achievements of the blind upon such of the Yerkes-Bridges tests as they performed, with the total performances of Cambridge school children. Seventy-two points of possible credit are common to the two point scales. The scores of the seventy-eight subjects of Group 1, blind from birth or early childhood, without eliminating any for any cause whatever, were counted up for these seventy-two points of possible Yerkes-Bridges credit. These scores were then raised to a percentage basis. For instance, the lowest scoring twelve-year old subject made a record of twenty-four points on the seventy-two points common to the two scales. This, divided by seventy-two, yields 33 per cent, which is, for the purpose of comparison with seeing children, considered this child's Yerkes-Bridges score. These scores were averaged for year groups. These averages for year groups are plotted as a curve in the solid line of Figure 3. The dotted line indicates the Yerkes-Bridges averages for four hundred and sixty-eight children of English speaking parentage. In comparison, the blind score lower from IX to XIII years inclusive. But the amount of departure from the tentative norms for seeing children, is at no point greater than the differences which Yerkes and Bridges find between the language groups at XII and XIII years.[4] These differences can not be made the ground, therefore, for maintaining a *general* mental inferiority of the blind, even in these years. And the

[4] See "A Point Scale for Measuring Mental Ability"—Yerkes, Bridges and Hardwick, p. 67.

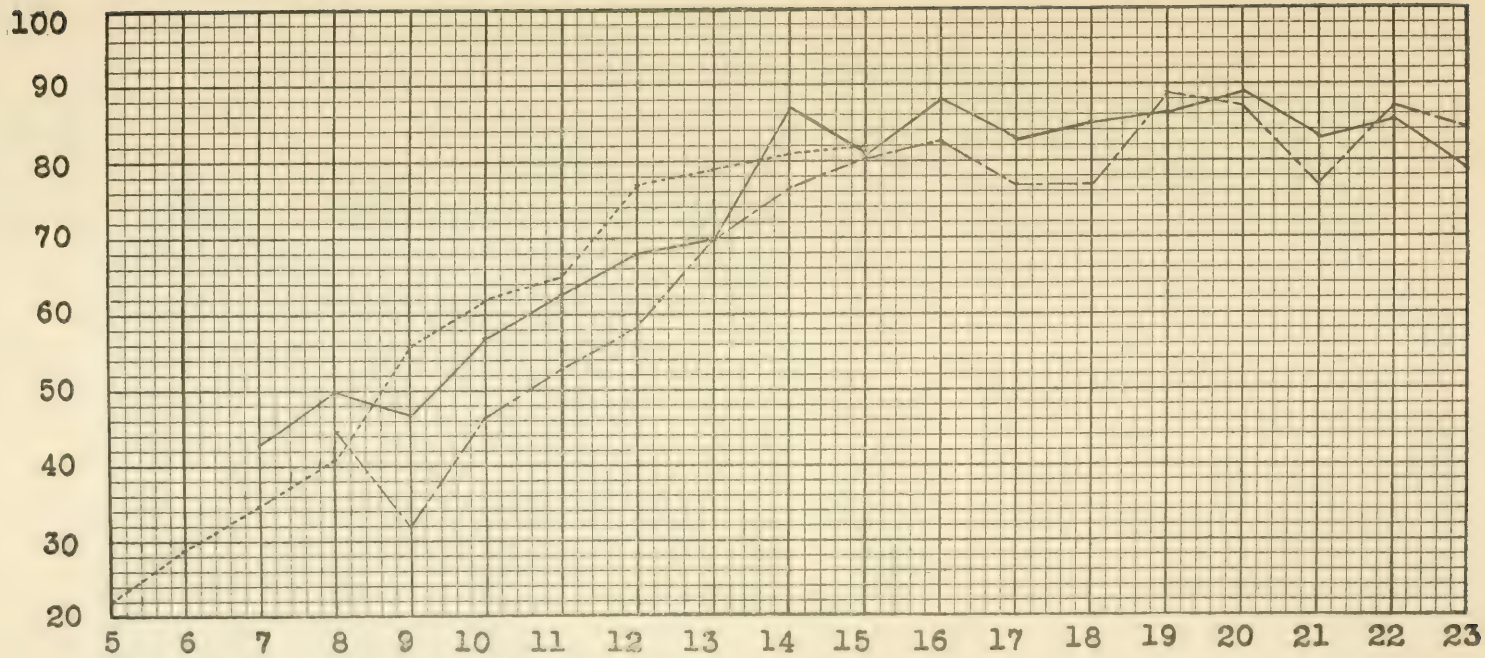

FIGURE 3. Averages of points scored by year groups:

(1) Dotted line (.....) Yerkes-Bridges averages for children of English speaking parents. (468).

(2) Solid line (———) averages of points scored on 72 points of Yerkes-Bridges Scale, by seventy-eight blind subjects, these scores being raised to percents. (78).

(3) Dash and dot line (—·—·—·) averages of eighty-two partly blind subjects (Group 4) by the Yerkes-Bridges Scale. (82).

Ordinates = points scored: abscissae = chronological ages in years.

indications, at VII, VIII, and XIV-years, are for a superiority in the mental processes tested by these tests. When the irregularities, inherent in the small numbers examined, are removed from this curve, it is highly probably there will be a much closer correspondence with the attainments of seeing children, year by year. It will be observed there are only one VII-year, one VIII-year, and two IX-year olds represented in this curve, presenting the averages of year groups of blind children. This comparison with the Yerkes-Bridges results seems to indicate that we have in the point scale a reliable means of measuring the intelligence of blind persons, and that the intelligence of the blind is not markedly inferior in grade, or different in quality from that of seeing subjects.

One other comparison of a part of this population with Cambridge School children is possible. Eighty-two subjects had vision sufficient for taking the Yerkes-Bridges Point Scale tests. The scores of these subjects are arranged in the order of attainment in year groups in Table VIII, and averages calculated. These subjects comprise all persons in the school of the visual capacity stated, whether feeble minded or supernormal. These averages are plotted in Figure 3, in the dash and dot line.

The inferiority in achievement of these partly blind subjects, in the four years from IX to XII, inclusive, is much more marked than that of the totally blind. They are generally inferior to the totally blind. This fact, together with the marked irregularity of the curve after XVI years, indicates that the group is more heavily laden with distinctly inferior mentalities,—that there is more feeble-mindedness among the blind who see, than among the really blind. In other words, some subnormality of vision has been made the excuse for constituting the school an asylum for some feeble-minded persons who should be in institutions for the feeble-minded. After eliminating such persons from this group, the average attainments of the remaining subjects, year by year, come very close to those of seeing subjects.

In view of these comparisons of attainment of blind and partly blind subjects with those of seeing subjects, there is no ground afforded for the view that the blind subject as such is lower than

the seeing subject in his ability to adapt himself to circumstances. The curves exhibited in Figure 3 certainly indicate that the blind subject has, on the tests afforded by the Point Scale of Yerkes and Bridges, the same kind of mental adaptability to circumstances as the seeing subject, and in approximately the same

Age	VIII	IX	X	XI	XII	XIII	XIV	XV	XVI	XVII	XVIII	XIX	XX	XXI	XXII	XXIII	XXIV
Scores	36	32	35	36	39	51	50	55	75	59	53	89	80	77	82	80	90
	54		36	50	39	56	60	60	80	71	62		90		85	89	
			49	59	59	66	74	74	85	75	67		91		86		
			55	69	60	72	76	80	90	85	75				96		
			60		61	72	77	87		85	76						
					61	73	78	88		87	86						
					64	77	81	88		88	89						
					65	78	88	91			90						
					66	83	89	92			95						
					68		92										
Av.	45.0	32.0	46.4	53.5	58.2	69.8	76.5	80.4	82.5	77.1	77.0	89.0	87.0	77.0	87.2	84.5	90.0
M. V.	9.0	—	9.3	10.5	7.7	8.2	9.2	9.7	5.0	9.0	11.5	—	4.7	—	4.3	4.5	—

TABLE VIII. Points scored on the Yerkes-Bridges Point Scale by the eighty-two partly blind subjects of Group 4, arranged in chronological year groups of the subjects and in the order of points scored.

measure. His mental furniture is different. It is needless to comment upon the necessity which the blind person finds laid upon him to build his world of other than visual imagery. But that he constructs his world and organizes his experience successfully, under this handicap, these figures testify. They make it plain that the blind child is not a defective because he is blind. A good cortex and good nervous system are not made incapable of normal adjustment in society by the lack of visual apparatus. On the other hand, there is an unusually large percentage of subnormal and feeble-minded in the population of this school. There is a considerable number in each one of our groups who fall so far below the average attainment for their ages, that they have to be considered defectives. These are blind persons in whom blindness proceeds from the same cause as does disease of the encephalon. They are feeble-minded, and they are blind, because they are hydrocephalic, have had encephalitis, now suffer from syphilitic degeneration of cortical cells, or are suffering from other pathological deterioration of brain and optic nerve. Such factors can and do cause both sense and brain defects. Taking into consideration the very heavy incidence of the gonococcus as an etiological factor in blindness (ophthalmia neonatorum), and that this infection is in no wise connected with feeble-mindedness in parents, but rather with their loose morals, we should expect to find relatively small numbers of blind children who are feeble-minded. If we could completely eliminate this cause of blindness the percentage of feeble-minded among the blind would materially increase; for of the other causes of blindness, nearly all are liable to cause brain disease or brain defect, which in turn, entail dementia or amentia. There would be fewer blind but of these a larger percentage would be defective.

In view of these facts, it is imperative to have a means of separating, for instructional purposes, the normally endowed blind and the mentally defective blind. This Point Scale for the Mental Measurement of the Blind has been devised with a view to facilitating the mental examinations of the Blind, and separating the two classes. This relatively small amount of data is put forth in order to stimulate the gathering of more data so that the averages may more closely approximate true age norms.

VII

Individual Binet-Simon Tests For a Year Scale

We present now the results obtained with single tests such as were used in the Point Scale, and many other intelligence tests. These data furnish means for a more rigid evaluation of results on the Point Scale, and for more accurate placing of tests in a Year Scale. The results obtained, with our relatively small number of blind subjects, point the way, at least, to the places these tests may be expected to occupy in a Year Scale for Measuring Mental Ability. Such a Year Scale would be a modification of the Binet-Simon Scale for measuring intelligence. It would be adapted to the Blind. This attempt to standardize simple tests;—to assign them to their places in the development of intelligence, leads to a further comparative study of blind and seeing subjects.

As a matter of routine, each examination of a blind subject covered a long list of tests outside of the Point Scale, as outlined above. A large Year Scale Record Blank was used upon which we had listed, provisionally, by years, all the Binet Tests adapted to the blind; and many others from sources already mentioned. As the Point Scale examination proceeded the plus and minus checks were made upon the Year Scale Blank, and when the Point Scale tests were completed, other year tests were administered according to the ordinary procedure,—to secure a basal year and get for the subject all the credits he could earn beyond that year.

As observed above, our data for contributing information on the value of Year Scale Tests, before the age of ten, are meagre. We present first what facts we have concerning the tests of Binet's 1911 series, as this is generally familiar. Then follow various supplemental tests. Roman numerals indicate the year, and Arabic numerals, the place in the tests of a given year assigned by Binet and Simon in the 1911 series.[5] The numbers in

[5] See "Mentally Defective Children"—Alfred Binet and Th. Simon. Translated by W. B. Drummond—London, 1914. Also "A Method of Measuring the Development of the Intelligence of Young Children"—Alfred Binet and Th. Simon. Translated by Clara Harrison Town. Lincoln, Ill.

parentheses, after P.S. indicate the Point Scale for the Blind *number* of the tests as given on pages 6 and 7.

III 3, (P. S. 1). Enumeration of objects in a basket. A substitute for the Binet enumeration of objects in a picture. Of fifty-two normal blind children, one VII-yr. old, one IX-yr. old, two X-yr. olds, two XI-yr. olds, and one XIV-yr. old failed to name all of the objects. The coat button figures in every one of these cases but the last. The XIV-yr. old pulled the shoestring out with the doll and failed to name the former. One of the XI-yr. olds missed the penny and button, and one of the XII-yr. olds, the shoestring and button. The button is not a familiar object to these children. A knife or a small bottle might be substituted. This test is a good substitute for Binet, III 3. All failures were due to carelessness. Limit in age is lower than can be fixed by our subjects.

IV 4, (P. S. 5 (a)). Comparison of 4 and 6 cm. sticks. A substitute for comparison of 5 and 6 cm. lines of Binet. Uniformly perfect score. May be an easy four-year old test.

V 1, (P. S. 5 (b) and (c)). Comparison of two weights, 6 and 15 gm., and 9 and 18 gm. Binet's method used with repetition of each comparison. Uniformly perfect records by all our normal blind subjects. Clearly below the age limits of our subjects.

V 5. Patience. Binet's visiting cards are not suitable as a test for the blind. Tactually presented the problem is too difficult. We used two blocks of wood 2½ x 4 inches, ½ inch thick, but bevelled to ¼ inch at edges. One of these was cut along one diagonal. The presentation is the same as with the Binet cards, with this exception: The limitations of the tactual sense for space perception dictate the presentation of the whole block first, and *then* the two pieces laid thus: . The bevel prevents an apparent fit when one piece is turned over. The blind subject gets the two pieces off the table and manipulates them up near his face. Four X-yr. olds, who tried this, all succeeded. These are their records of time and moves:—16 sec., 3 moves; 30 sec., 5; 50 sec., 4; 80 sec., 7. We have 25 other records up to 21 years. All were successful. One can get no standard from such

limited data. It looks, however, as if, with a limit of thirty seconds after the task is fairly presented and allowance of four or five moves, it might be a fair X-yr. old test for the blind child. Binet's Patience Test is a V-yr. test. Extensive use with younger children may indicate lower limits for this, but it is clearly a more difficult task for the blind than is the card for the seeing child.

VI 2, (P. S. 8). Definitions. Four asked for. Of three IX-year olds, one gave all in terms of use and the others each gave three of four in terms of use. Of seven X-year olds five gave four definitions each in terms superior to use, one gave three, and one gave only one in terms superior to use. It seems probable that three of four definitions given in terms superior to those of use constitute an easy X-year test for blind children.

VI 5, (P. S. 9). Aesthetic Choice of Tactual Impressions. Two pieces, one of silk and one of serge, are put into S.'s hands, and he is asked which feels the nicer. The same with velvet and serge, and with velvet and carpet. In only one case of the fifty-two normal blind subjects was there any variation from "*silk* feels nicer than serge, *velvet* feels nicer than carpet, and *velvet* feels nicer than serge." In that case the boy gave *silk* once and *serge* once, as feeling the nicer of these two. This test is clearly at a lower limit of age than that of any person we tested.

VII 4. Counting 9c in blocks. (Binet's giving value of nine sous, three of which are double, and Goddard's counting value of stamps,—three one-cent and three two-cent stamps). Our test consists of counting the value of three large blocks, which in play are considered pieces of candy worth 2c each, and three small blocks considered pieces of candy worth 1c each (Irwin).

At VII years one of one succeeds.

At VIII years one of one fails.

At IX years two of three succeed.

At X years three of six succeed.

At XI years three of four succeed.

Beyond XI all succeed.

Ten seconds seems to be ample time after the problem is definitely comprehended. Is probably a VII-year test.

VIII 1, (P. S. 12). Differences. Two distinct differences between each of two of three pairs of objects:

(a) Apple and banana
(b) Wood and glass
(c) Paper and cloth

The objects compared are different from those of Binet, and two differences are required, in each case.

At IX years one of three subjects succeeds.

At X years five of seven subjects succeed.

At XI years five of six subjects succeed.

With the standard adopted this is probably a X-year test for the blind. There is a chance it will go lower, with more numerous results.

VIII 2, (P. S. 14). Counting backward from 20 to 1. Six of seven X-year olds do this without any error, in an average of 14 seconds each. Eighteen seconds is the longest time recorded. Of three IX-year olds one does it without error in 15 seconds; one, with one error in 20 seconds; one utterly fails. One VIII-year old does it without error in 17 seconds. Very likely an VIII-year test. Our group of IX-year olds are exceptionally slow.

VIII 4. Day and Date. The day of the week, the year, and the month, were known, and the day of the month within three days, by one VIII-year old, by four of seven X-year olds, and by five of six XI-year olds. One VII-year old and three IX-year olds failed. It is probably a high X-year test for the blind.

VIII 5, (5 digits) (XV-years seven digits). Memory Span for Digits. In repeating digits the blind seem superior. Repeating six digits is probably an VIII-year memory span for the blind. It is done by one VIII-year old, two of three IX-year olds, and seven of seven X-year olds, and four of six XI-year olds.

Repeating 7 digits.

At X years five of seven succeed.

At XI years four of six succeed.

At XII years three of three succeed.

At XIII years two of three succeed.

At XIV years five of five succeed.

Repeating 7 digits is probably an average accomplishment of a X-year old blind child.

Repeating 8 digits:

At XIV years five of five succeed.

At XV years one of three succeeds.

At XVI years two of three succeed.

At XVII years two of three succeed.

At XVIII years four of five succeed.

This may be a XIV-year test for the blind.

Goddard's standards are: 3 digits = VIII years,
6 digits = X years,
7 digits = XII years.

Terman's standards are: 5 digits = VII years.
6 digits = X years,
7 digits = XIV years,
8 digits = XVIII years, or high adult.

IX 3. Naming Coins. The five coins, penny, nickel, dime, quarter, and half dollar, were laid on the table, and the subject was asked to name each, as he handled it. Absolute accuracy was required for credit. Results on this test are very unsatisfactory. The differentiation of a penny and dime by a blind person depends upon a special piece of knowledge, the milled edge of the dime. For the institution child this is very special.

At IX years one of three succeeds.

At X years three of five succeed.

At XI years one of three succeeds.

At XII years two of two succeed.

At XIII years one of two succeeds.

At XIV years three of three succeed.

It *may* be a XII-year test.

IX 4. Months named. The months were named correctly by a VII-year old, by one of two VIII-year olds, by one of two IX-year olds, and by seven of seven X-year olds. Each of these gave them in 10 seconds, or less. Most gave the three checks, "What month before April; July; November?" correctly. Giving all the months with no error in 10 seconds, and three checks correctly, is probably an VIII-year test.

IX 5. Comprehension. We used the questions of Terman's 3″ Degree Comprehension series, and recommend also his 1″, 2″, and 4″ Degree Comprehension Tests, as designed for years IV, VI, and XI respectively. This 3″ degree series, two of three correct, he finds standard for VIII years. The questions are as follows: "What's the thing for you to do"

(a) "When you have broken something which belongs to someone else?"

(b) "When you notice on your way to school that you are in danger of being tardy?"

(c) "If a playmate hits you without meaning to do it?"

Scores for 3″ degree, VIII-year:

At VII years one gives only one correct answer.

At VIII years one succeeds.

At IX years one of three succeeds.

At X years six of six succeed.

May be an VIII-year test for blind. Data are too limited for standardizing the test. Certainly lower than a X-year standard.

4″ Degree Comprehension. (Terman, XI-year test, two of three answered correctly.)

(a) "What ought you to say when someone asks your opinion about a person you don't know very well?"

(b) "What ought you to do before deciding something very important?"

(c) "Why should you judge a person more by what he does than by what he says?"

(d) "Why do we more easily forgive an unkind act done in anger than one done without anger?"

Our subjects failed to score 75 per cent cases correct before XII years. Three XII-year olds tried and each gave two correct. Of five XI-year olds tried, one made no score, two gave one correct answer each, one gave two, and one two and one-half. Probably a XII-year test for the blind.

X 1, (P. S. 18). Arranging Weights. By the Binet standard, two of three trials correct, this looks like a high X-year test for blind. Binet placed it at X years for seeing children.

At VII years one succeeds.

At VIII years one fails.

At IX years two fail.

At X years four of seven succeed in 1″ or 2″ trial. Only one fails in both 1″ and 2″ trials; one in 1″ and 3″; and one in 2″ and 3″.

At XI years five of six succeed, or 83.3 per cent (1″ or 2″ trials). By the Yerkes-Bridges standard (either one of two trials correct), it is much easier. One at VII years, one at VIII years, and two at IX years all pass.

X 3, (P. S. 19). Absurdities.

Yrs. of Age	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
No. of	1	1	2	5	4	5	5	5	4	5	5	5	4	5	5	5
Absurdities			1	2	4	5	4	5	4	5	4	4	3	5	5	5
each subject				2	4	3	2	5	4	4	3	3		5	5	4
saw through				2	2		1	4								
				1	1			3								
				1	0											
				0												

TABLE IX. Shows the numbers of the five absurdities (see instructions for the P. S. for the Blind, No. 19) each one of the fifty-two normal blind subjects saw through and explained. Arranged in year groups and in the order of achievement.

Our results possibly indicate the following age norms for the blind in "Absurdities":

Five absurdities out of five = XX years.

Four absurdities out of five = XIV years.

Three absurdities out of five = XI years.

Two absurdities out of five = X years.

Four of five correct is clearly an easy XIV-year test.

X 5, (P. S. 17). Three given words in a sentence. A XII year test for the blind.

At XI years one of six succeeds.

At XII years two of three succeed.

At XIII years three of four succeed.

At XIV years four of five succeed.

At XV years two of three succeed.

Three words in two clauses or sentences. A high XI year test.

At X years three in seven succeed.

At XI years four in six succeed.

At XII years two in three succeed.

At XIII years four in four succeed.

All who attain either result do it in less than 60 seconds.

XII 1, (P. S. 7). Resisting suggestions. Wooden cubes placed in the two hands. Results: One VII-year, one VIII-year, and one IX-year old succeed. One VIII-year old fails.

Resisting two of the three (numbers 4, 5, and 6), by giving "left larger" or "just the same," constitutes a pass. At X years five of seven "resist the suggestion" (four of these make 3 in 3).

At XI years six of six resist the suggestion. Probably a lower than X-year test for the blind. In Group 4, (subjects saw the lines and took the regular Binet test) forty-five records, including two VIII-year olds and two X-year olds, are practically all passes. This, too, indicates a lower than X-year test.

XII 3, (P. S. 11). Words given in three minutes. Free association. (See description, P. S. 11). Giving forty words in three minutes seems to be the normal accomplishment of a VII or VIII-year old blind child. Sixty words normal to X years; eighty words normal to XIV years.

Yrs. of Age	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
	40	48	46	92	106	112	84	128	129	108	126	168	132	96	126	124
			44	76	87	92	69	87	110	86	101	91	119	86	115	91
			16	73	82	37	54	85	83	57	89	91	78		94	65
				73	71		50	56				70	77			
				67	51			53								
				57	36											
				34												

TABLE X. Presents the numbers of words given in three minutes by normal blind children in order of age and accomplishment.

XII 4, (P. S. 20). Definitions of abstract terms. (Obedience, charity, and justice). One of three correct. Normal for XI years.

At VIII years one of one succeeds.

At IX years neither of two succeeds.

At X years four of seven succeed.

At XI years four of five succeed.

At XIII years three of three succeed.

Two of three correct.

At XIII years two of four succeed.

At XIV years four of six succeed.

At XV years three of three succeed.

Probably normal for XIV years. The same figures hold for three of three correct at XIV and XV years. This also is a XIV-year attainment.

XII 5, (P. S. 22). Disarranged sentences. Presented in New York Point.

Two of three correct.

At X years one of eight succeeds.

At XI years two of two succeed.

At XII years two of three succeed.

At XIII years two of four succeed.

At XIV years three of four succeed.

At XV years three of three succeed.

The blind child often requires longer than 60 seconds. Finger reading is a slower and more absorbing process. A XIV-year old test for the Blind.

XV 2. Rhymes. Three for each one of three words in three minutes.

At IX years none of two succeeds.

At X years six of seven succeed.

At XI years five of six succeed.

Twenty-eight older persons, tested, all succeeded. A X-year test.

XV 3. (P. S. 3 (c)). Verbal Memory. Binet used twenty-six syllables. We used twenty syllables in two sentences. "It is not necessary to hurt the birds. It is night and all the world rests in peace." Absolute accuracy necessary to score. Given in the Point Scale after two shorter sentences.

At VIII years one of one succeeds.

At X years four of seven succeed.

At XI years one of eight succeeds.

At XII years one of three succeeds.

At XIII years two of four succeed.

At XIV years five of five succeed.

At XV years none of three succeeds.

At XVI years two of three succeed.

May be a XIII-year test for the blind. This is not a satisfactory

verbal memory test. Terman's XI-year, one out of three correct, works much better, and is probably placed about right for the blind.

XV 5. Problems of Fact. Add to the two of Binet, Terman's "White man walks sitting down." Credit for two of three correct.

At XI years two of three succeed.
At XII years two of two succeed.
At XIII years neither of two succeeds.
At XIV years one of five succeeds.
At XV years three of three succeed.
At XVI years one of two succeeds.
At XVII years two of three succeed.
At XVIII years one of four succeeds.
At XIX years one of two succeeds.
At XX years three of three succeed.
At XXI years three of three succeed.
At XXII years two of three succeed.

No standard derivable from these data. Not a satisfactory test for seeing persons. For the blind, the limitations of experience present special difficulties.

Adult 3. Differences in meaning between abstract terms. Terman's five pairs substituted for Binet's three pairs:

Laziness and idleness.
Poverty and misery.
Character and reputation.
Pride and pretension.
Evolution and revolution.

One clear difference stated for each one of three of the five pairs necessary for a pass (Terman).

At X years one of one fails.
At XI years one of one fails.
At XIII years two of two fail.
At XIV years three of three fail.
At XV years three of three fail.
At XVI years one of two succeeds.
At XVII years three of three fail.
At XVIII years one of three succeeds.

At XIX years one of two succeeds.
At XX years one of one succeeds.
At XXI years one of two succeeds.
At XXII years three of three succeed.

Unsatisfactory results. Seems safe to consider it a high adult test for the blind.

Adult 4. Differences between king and president of a republic. Two of three necessary to score. All fail up to and including XIII years.

At XIV years one of three succeeds.
At XV years four of four succeed.
At XVI years one of two succeeds.
At XVII years three of three succeed.

A low XV year test for the blind.

Binet 1908 Series, X year. Memory of Selection read once to subject.

"FIRE DESTROYS THREE HOUSES"

"New York, Sept. 5. A big fire in Kingston last night destroyed three large houses in the centre of the town. Seventeen families are without shelter. The loss is more than thirty thousand dollars. While saving a child in his cradle, a barber's boy had his hands very seriously burned."

This is a modified form of the Binet 1908 X-year test. Goddard recommends an easier one as a IX-year test. Terman uses a similar story as a X-year test. He has twenty-one items, allows three mistakes in reading and requires eight items. Seeing subjects read the selection aloud once. To the blind the above selection was read once very carefully. At X years seven subjects gave 14, 12, 11, 10, 8, 6, and 3 items. At XI years five subjects gave 13, 12, 12, 11, and 4 items. All good results were attained in less than 60 seconds after the reading. Eight items in 60 seconds is indicated as a X-year test for the Blind. Possibly eleven or twelve items may prove to be an XI-year standard. The *news item* feature of the selection is confusing. The blind subject does not understand the repetition. The two places mentioned often lead him to speak of two fires. A simple narrative would be better. Thorndike's Shipwrecked Sailor is recommended.

Designation of Test	Year assigned by Binet, 1911.	Year assigned by Goddard.	Year assigned by Terman.	Tentative year place for the Blind
Comp. of 6 & 15 gm. wgts.				Below
and 9 & 18 gm. "	V	V	V	VII
Defins. sup. to use.	IX	IX	IX	X
Diff's bet. 2 things.	VIII	VIII	VII	VIII?
Count. backward 20-1	VIII	VIII	VIII	VIII?
Day and date	VIII	IX	IX	X+
Memory Span, 5 digits	VIII	VIII	VII	
Memory Span, 6 digits		X	X	VIII?
Memory Span, 7 digits	XV	XII	XIV	X?
Memory Span, 8 digits			XVIII	XVI?
Naming Coins		X (9 pieces)	VI (4 pieces)	XII? (5 pieces)
Naming Months	IX	IX (1 omiss.)	X (no omiss. 3 checks)	VIII? (3 checks)
Comprehension, 3" Deg.			VIII	IX
Comprehension, 4" Deg.			XI	XII
Arranging Weights	X	IX	X	X+
Absurdities	X (3 of 5)	XI (3 of 5)	XI (4 of 5)	XI (3 of 5) XIV—(4 of 5)
Three words in two sentences	X	X ½ succeed XI all " IX		XI+ (3 words in 1 sent. XII)
60 words in 3 minutes	XII	XI	XI	X
Definitions of 3 abs. terms	XII	XII	XII	XI (1 of 3) XIV (3 of 3)
Disarranged sentences	XII	XII	XII	XIV
Rhyming	XV	XI	IX	X
Problems from Facts	XV	XII	XIV	not derivable
Difference bet. 3 of 5 abstract terms	Adult	Adult	XVI	High Adult
Differences bet. King and President	Adult	Adult	XVI	XV

TABLE XI. Standards of Tests by years by (1) Binet, (2) Goddard, (3) Terman, and (4) for the Blind.

In table XI we exhibit in parallel columns the years for which Binet (1911), Goddard, and Terman, have considered twenty-three tests standard, in so far as each of these investigators *has proposed* standards for these tests. In the fourth column the years are set down which are pointed out as probable standards for these tests from the survey of blind subjects herein reported. Of these the following tests come at *later* years for the Blind than for seeing subjects:

1. Definitions superior to use.
2. Day and date.
3. Naming coins.
4. Comprehension tests.
5. Absurdities.
6. Disarranged sentences.

The following come at earlier years:

1. Memory Span for digits.
2. Naming months.

As we had so few subjects under ten years of age, every suggestion of standard below ten must be received with great caution. Such tests as (1) Enumeration of Objects in a Basket, (2) Comparison of 4 and 6 cm. sticks, and (3) Aesthetic Choices between kinds of fabric, are certainly standard for years below X. But no definite standard can be set from our data for any one of these tests.

Our substitute for Binet's Patience, (V yr.) necessitated by the sensory limitations of the blind, seems to be a much more difficult test for the blind, than is the *Patience* with cards for the seeing subject. The *Block* Patience is provisionally placed as a X-year test for the blind.

In substituting blocks for the lines of Binet in the "resisting suggestion" test, one *may* have adopted a radically different standard of suggestion. Only a long series of experiments with normal subjects would prove what tactual differences in cubes are comparable to visual differences of 1 cm. in lengths of lines from 4 to 7 cm. The method of presentation is not parallel. As to the mental processes involved in the judgments made, however, there can be no doubt that this block test exhibits the same

"suggestibility resulting from heedlessness or lack of attention,"[6] in the blind who fail, as do Binet's lines in the seeing who fail. Also the same elements of character and emotion and feeling come into play in this block test as in the line test.

Our results place this certainly as low as X, and indicate it may go lower. Binet and Goddard consider the *lines suggestion,* a XII-year test. Terman lowers it to IX. This accords with the writer's experience with the line test with delinquents who prove defective. In scores of records this test stands with a *plus* check, whereas all other XII and XI-year tests are marked minus. Results from the pupils at the Ohio State School for the Blind, who see sufficiently to take the line test, also bear out the same point, that this quality of critical attention, and resistance, to the easy path of habit, is a quality of mind which emerges between IX and X years of age.

[6] See a Meth. of Measuring the Devel. of the Intell. of Young Children, Binet and Simon. Trans. of Dr. Town, p. 53.

VIII

Other Individual Tests for a Year Scale

1. Knox Lines, revised by Pintner. Pintner's provisional standards are:

1 of lines X and Y correct = V year.
1 of lines B, C and D correct = VI year.
2 of lines B, C and D correct = VII year.
1 of lines E, F and G correct = X year.

Group 1 with Fingers.

Group 1 with Fingers.

Age	10	11	12	13	14	15	16	17	18	19	20	21	22
Nos. of subjects tested.	7	6	3	4	5	3	3	2	4	2	3	4	3
Of lines B, C, & D, two correct.	2	6	3	2	5	3	3	2	4	2	3	3	3
" " E, F, & G, one correct.	5	5	3	3	5	3	2	1	4	3	3	3	3
" " E, F, & G, two correct.	2	3	2	2	5	2	2	1	2	2	1	0	2
" " H, I, & J, one correct.	2	1	2	1	2	2	1	1	1	0	1	2	3
" " H, I, & J. two correct.	0	0	2	0	1	2	0	0	1	0	0	0	2
Group 4 with Cubes.													
Nos. of subjects tested.	2	2	6	6	6	5	2	3	3	—	2	—	2
Of lines B, C, & D, two correct.	2	2	5	6	4	5	2	3	4	—	2	—	2
" " E, F, & G, one correct.	2	1	3	6	5	4	3	3	3	—	2	—	2
" " E, F, & G, two correct.	0	1	1	4	4	2	1	2	2	—	2	—	1
" " H, I, & J, one correct.	0	0	1	2	1	3	1	1	2	—	1	—	—
" " H, I, & J, two correct.	0	0	0	1	1	2	1	0	0	—	0	—	—

Table XII. Gives the numbers of subjects in age groups of Group 1 and Group 4, and the numbers of subjects reaching various stated standards with the Knox Lines by *finger* and *cube* methods.

The data from the blind subjects working with finger touching (Group 1), and from others with sufficient vision to use the cubes (Group 4) are presented for comparison with these standards in Table VII. *Two* correct, of lines B, C, and D, as a cube test, seems to be lower than X for seeing subjects, but about an XI-year test for the blind. *One* correct, of *E, F,* and G gives promise of working out to a less than X-year test for both seeing and blind subjects. If this system of evaluation is adopted, (year standards) *one* of E, F, and G correct is apparently a better and easier standard than two of B, C, and D.

Further, on this line of year standards, *two* of E, F, and G correct, seems a fair XIV-year standard for the blind, and XIII-year standard for seeing subjects. *One* of H, I, and J may be a XV-year standard for both classes. It must be allowed, however, that these results do not afford a sufficient basis for more than the most preliminary guessing as to year standards. Unless larger numbers later indicate a more even progress of accomplishment, following the years, one must question whether these Knox Lines measure any mental capacity which develops through these adolescent years from X to XX. The lines, whether perceived visually or tactually, do present an admirably graded series of spacial and temporal *plans,* or organizations of motor coördinations, to be carried out by the subject. They undoubtedly have a valuable place as year tests below X, and are well worth preservation as an integral part of a point scale. It may well be a somewhat specialized mental capacity,—this ability to schematize and set in their relations to each other, in time and space, a series of tactual or visual stimuli, and to represent them through one's own activity. Auditory and visual memory are clearly recognized as such fields of wide individual variation. The existence of such individual variations, and these varying independently of age development, is an argument, however, not against an attempt at measurement, but against measurement of mental process in terms of years of age. It is an argument against year scales, and for such a scale as will measure mental process by mental process,—the only known unit of mental measurement. Such a scale is the point scale.

The Finger Tapping Test demands memory for temporal and spacial relations, constructive imagination, and facility in motor coördination. It is not the same kind of construction and execution, as those employed in the Cube Test. Not only is the structural material different, inner and outer tactual imagery, with no visual, but the pattern must seem much more intimately a part of one's self. For all this intimacy though, a series consists of a number of frequent and habitual movements, which are so habitual that they are hard to coördinate by voluntary direction. One encounters here the difficulty of control and

Years of Age	Finger Tapping Blind Subjects Group 1 No.	Av. No. of lines passed	Cube Test Seeing Subjects O. S. S. B. Group 4 No.	Av. No. of lines passed	Cube Test Pintner's school children Av. No. of lines passed
IV					0.43
V					1.41
VI					3.22
VII	1	0			4.12
VIII	2	3.00	2	6.50	4.60
IX	2	3.00	1	2.00	4.59
X	10	4.10	5	4.60	5.29
XI	9	4.33	4	5.00	5.68
XII	5	6.00	8	5.62	5.96
XIII	6	5.50	8	7.25	5.66
XIV	5	7.40	8	6.50	6.55
XV	5	6.80	6	6.83	6.45
XVI	4	6.00	3	8.00	7.05
XVII	4	6.00	3	6.33	
XVIII	5	6.80	5	6.60	
XIX	4	6.25	1	7.00	
XX	6	5.80	3	7.00	
XXI	6	5.50	0		
XXII	5	6.00	2	6.00	

Table XIII sets forth the average numbers of the eleven Knox Lines given correctly by each year group of subjects of Group 1 and Group 4. We also give Pintner's average numbers of lines passed at given years by children in the public schools.[7]

organization of reflexes. The processes involved seem more difficult, on comparison of the *finger tapping* results of Group 1 with the *cube* results of Group 4. In nine of fourteen years, where results are at hand for both groups, we find the cube tests of Group 4 averaging higher, whereas Group 4, in average attainments by Point Scale, runs lower than Group 1 (*cf.* figure 3).

In seven of ten comparable year groups, Pintner's subjects also show results superior to those of blind subjects. These data as to different numbers of lines for the seeing (Pintner's results with cubes, one line subtracted) and for the blind (with finger tapping) seem to suggest the following as tentative and provisional standards.

[7] See "The Standardization of Knox's Cube Test," by Rudolph Pintner, The Psychological Review, Sept., 1915, page 395. Pintner counted Line A in his scores. We may assume Line A was always correct. Subtracting one from each of his averages, we have reasonably satisfactory data for comparison with our averages.

	Seeing (Cubes)	Blind (Tapping)
Three lines	VI years.	VIII years.
Four lines	VII years.	X years.
Six lines	XI years.	XII years.

2. Adaptation Board (P. S. 6) (Goddard, with Pintner's technique). Summary Record of blind subjects: (a) First trial correct in three of four changed positions.

At VII years one of one succeeds.
At VIII years one of one fails.
At IX years one of two succeeds.
At X years six of seven succeed.
At XI years five of six succeed.

(b) First trial correct in four changed positions.

At X years three of seven succeed.
At XI years one of six succeeds.
At XII years three of three succeed.
At XIII years two of four succeed.
At XIV years none of five succeeds.
At XV years three of three succeed.
At XVI years three of three succeed.

One trial correct in three of the four positions, seems to be a low X-year test, six out of seven, or 85 per cent, attaining to this or better. The data below X are too limited, however, to preclude moving this standard lower. All of the four positions correct, first trial, seems to be a XV-year attainment for the blind subject.

3. Size-Weight Illusion.

Below X years two of four succeed.
At X years seven of seven succeed.
Above X years forty-eight of fifty succeed.

Standard for some age below X.

4. Knows Birthday. The date of birth is assumed to be that upon the institution records. This record is not infallible. This impairs the value of the test for institution cases.

At VII years one of one fails.
At VIII years one of one succeeds.
At IX years two of three succeed.

At X years five of seven succeed.
At XI years five of five succeed.
At XII years three of three succeed.
At XIII years three of four succeed.
At XIV years five of five succeed.
At XV years two of three succeed.

A purely information test. Not of much value in measuring development of mental capacity. Is probably a VII-year standard.

5. Season of the year. "What season of the year is this?" was followed by "What season came before this?" "What season comes after this?" All three were answered correctly in all of thirty cases of Group 1 tested. These thirty include one VII-year old, two VIII-year olds, two IX-year olds, and seven XII-year olds. The test evidently falls in the years earlier than VII.

6. Repeating digits backward. Numbers are given at the rate of one per second, and three trials are given before recording a failure. Reversing three digits may be an VIII-year test. Our one VIII-year old fails on three and succeeds on four digits. One IX-year old reverses four and another reverses five digits. Reversing five may be a IX-year test. Reversing six digits is accomplished by 80 per cent of the XIV-year olds, and only 50 per cent of the XIII-year olds, but 100 per cent of the three XII-year olds. Probably a XIV-year test. It may be a XII-year test. Terman considers reversing of three digits an VIII-year test, and reversing five digits a XII-year test.

There are some indications that the blind show the same advancement over seeing subjects in reversing as in repeating series of digits. This is to be expected. The subject who is to reverse a series is often heard to repeat the series as given before reversing it. Ability to give a series reversed depends first upon ability to *remember* the *series*.

7 Similarities of two things (Terman). Credit for three of five correct. "In what way are ———— and ———— alike?"

(a) "Wood and coal?"

(b) "Apple and peach?"

(c) "Iron and silver?"
(d) "Ship and automobile?"
(e) "Cat and bird?"
At IX years three of three fail.
At X years four of seven succeed.
At XI years five of six succeed.

A high X-year test for the Blind. Terman considers this a standard accomplishment for IX years.

8. Similarities of three things (Terman). Credit given for three of five correct. In what way are ———, ———, and ——— alike?"

(a) "Snake, cow, sparrow."
(b) "Wool, cotton, leather."
(c) "Knife-blade, penny, piece of wire."
(d) "Rose, potato, tree."
(e) "Book, teacher, newspaper."
At XI years one of six succeeds.
At XII years two of three succeed.
At XIII years two of three succeed.
At XIV years four of five succeed.

Seemingly a XII-year old test for the blind. Terman considers this a standard XII-year accomplishment.

9. Naming days of week backward. In fifty-four records there is only one error in this test. One of three IX-year olds made this single omission. One VII, and one VIII-year old performed the task correctly. Probably a VII-year test or even VI. Eight seconds time is sufficient.

10. Naming months backward.
At IX years none of two succeeded without error.
At X years four of seven succeeded without error.
At XI years five of six succeeded without error.

Appears to be a high X-year test.

11. (P. S. 10 (a)). Touching right hand of examiner, sitting opposite with his hands upon his knees.
At VII years one of one succeeds.
At VIII years one of one succeeds.
At IX years three of three succeed.

At X years four of seven succeed.

At XI years five of six succeed.

The only failure among thirty-nine subjects of groups 2 and 3 is one at VIII years. This is probably a VI or VII-year test. The percentage of failures at X dictates caution and accumulation of more data.

12. (P. S. 10 (b)). Orientation. Knowledge of the relative positions of cardinal points of the compass. Requires accuracy in both tests, pointing to the other three cardinal points of the compass when facing north, and when facing east. This appears to be a XV-year test for the blind. With seeing subjects of the same school, it is clearly a test falling lower than X years.

Results with the blind of Group 1:

At VII years one of one fails.

At VIII years one of one succeeds.

At IX years one of three succeeds.

At X years four of seven succeed.

At XI years four of six succeed.

At XII years three of three succeed.

At XIII years two of four succeed.

At XIV years two of five succeed.

At XV years two of three succeed.

At XVI years three of three succeed.

At XVII years two of two fail.

At XVIII years three of four succeed.

In Group 3, twenty-three subjects from X to XXI all succeed.

13. Problems of Enclosed Boxes (Terman). One large box containing:

(a) Two smaller; and one inside of each of these latter.

(b) Two smaller; and two inside of each of these latter.

(c) Three smaller; and three inside of each of these latter.

The question in each case is, "How many boxes all together?" Two of the three must be answered correctly. A box was put into the hands of the blind subject, and he was asked the three hypothetical questions in order, in regard to that box.

Results:

At X years one of four succeeds.
At XI years four of five succeed.
At XII years three of three succeed.
At XIII years two of three succeed.
At XIV years one of five succeeds.
At XV years two of three succeed.

Only two failures with twenty-one subjects above XV. It seems quite possible this may prove a lower standard test for the Blind than for Terman's seeing subjects. For the present we must consider it a test for XV years.

14. (P. S. 21). Analogies. (Yerkes and Bridges. Adopted from Stanley Wyatt.)

Age	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
Nos. of	3	1	3	4	5	5	6	6	5	5	6	5	6	6	5	6
analogies			2	4	3	5	5	6	5	4	6	4	4	6	5	6
correctly				2	3	4	3	4	4	3	3	3		4	4	5
completed.				2	2		1	3				3				
Each no.				2	2			2								
is the				2	1											
record of				1												
one subj.																

TABLE XIV. Numbers of analogies correctly completed shown by age groups of subjects.

The total number of analogies was six. (See description, P. S. 21). These results of analogy tests with blind subjects indicate a value of the test as in itself constituting a scale for intelligence measuring. Two of the six analogies completed indictates a level of IX years or beyond. Three of the six completed indicates a level of XII years or more. Four of the six completed indicates more doubtfully a level of XV years.

15. Arithmetical Reasoning (Terman). Two of three problems correct. Sixty seconds each.

(a) "A man earns $20 a week and spends $14. How long will he require to save $300?"

(b) "If three pencils cost 5c, how many can one get for fifty cents?"

(c) "At 15c a yard, how much will 7 feet of muslin cost?

At X years one of one succeeds.
At XI years one of four succeeds.

At XII years one of two succeeds.
At XIII years two of three succeed.
At XIV years four of five succeed.
Beyond XIV twenty-one of twenty-three succeed.
Clearly a XIII-year test for these blind subjects.

Summary of tentative year values of Tests, other than Binet's, for mental measurement of the blind:

1. The Knox Lines given and represented upon fingers.
   For X years one of E, F, and G, correct.
   For XI years two of B, C, and D, correct.
   For XIV years two of E, F, and G, correct.
   For XV years one of H, I, and J, correct.
2. Goddard's Adaptation Board. (Pintner's four moves).
   For X years or lower, 1″ trial correct in three of four positions.
   For XV years 1″ trial correct in four of four positions.
3. Size Weight Illusion.
   For lower than X years.
4. Knows birthday.
   For lower than VIII years.
5. Knows season of the year.
   For VII years or lower.
6. Repeating digits backward.
   For VIII years reversing three digits.
   For IX years reversing five digits.
   For XIV years reversing six digits.
7. Similarities of two things.
   For X years, high. (Terman, IX years).
8. Similarities of three things.
   For XIV years. (Terman XII years).
9. Naming days of the week backward.
   For VII or VI years.
10. Naming the months backward.
    For X years, high.
11. Touching right hand of examiner, sitting opposite with his hands on his own knees.
    For VII or VI years.

12. Orientation. Cardinal points of the compass.
    For XV years.
13. Problems of enclosed boxes.
    For XV years.
14. Analogies.
    For IX years, two analogies completed.
    For XII years, three analogies completed.
    For XV years, four analogies completed.
15. Arithmetical Reasoning.
    For XIII years. (Terman XVI years).

Arrangement of the individual tests (including Binet Tests), under the years for which they are provisionally indicated as standard by these examinations of fifty-two blind persons.

For VII or VI or lower:

(Data are insufficient for a more accurate placing of these tests.)

Naming days of the week backward.
Touching right hand of examiner.
Size-Weight Illusion.
Knowing birthday.
Knowing season of the year.
Comparison of 6 and 15, and 9 and 18 gm. weights.
Memory Span for five digits.
Naming *forty* words in three minutes.

For VIII.

Differences between two things.
Counting backward from 20 to 1.
Memory Span of six digits.
Reversing three digits.
Naming the months.

For IX.

Comprehension, Terman's 3″ Degree (2 of 3).
Reversing five digits.
Two of six analogies completed (Wyatt).

For X.

Definitions superior to use.
Day and date.

Memory Span for seven digits.
Arranging weights.
Naming 60 words in three minutes.
Rhyming.
One of E, F, and G, Knox Lines correct.
Three positions of Adaptation Board, 1″ trial.
Similarities of two things (3 of 5).
Block Patience.
Resisting suggestion (Blocks).

For XI.

Three of five "absurdities" explained.
Three words in two sentences.
One of three abstract terms defined.
Two of B, C, and D, Knox Lines correct.

For XII.

Naming five coins.
Comprehension, Terman's 4″ Degree (2 of 3 cor.).
Three of six analogies completed (Wyatt).

For XIII.

Arithmetical reasoning (Terman). (2 of 3 cor.)

For XIV.

Four of five "absurdities" explained.
Three abstract terms defined.
Disarranged sentences put together (2 of 3).
Two of E, F, and G, Knox Lines correct.
Reversing six digits.
Similarities of three things (Terman). (3 of 5 cor.)
Naming 80 words in three minutes.

For XV.

Differences between president and king.
One of H, I, and J, Knox Lines, correct.
Adaptation Board, four positions correct 1″ trial.
Orientation. Cardinal points of the compass.
Problems of enclosed boxes.
Four of six analogies completed (Wyatt).

For XVI.

Memory Span of eight digits.

For High Adult.

Differences between abstract terms.

Many other intelligence tests of years III to VII, beside those mentioned above, are adaptable to the blind. No difficulty will be found in standardizing sufficient tests for each year, of the year scale, for the blind.

IX

The Mental Organization of the Blind Compared With That of Seeing Subjects by Means of Intelligence Tests

Reference has already been made to the comparative rating of intelligence of blind and seeing subjects as these are revealed by point scales for measuring intelligence. Therein we found no reason to concede any superiority, in the matter of adaptability to his environment, to the seeing subject. There appeared no fact making for the inferiority of the intelligence of the blind, because of his sense defect. It was recognized, however, that the deprivation of visual imagery makes necessary the use of an entirely different architectural plan, for the blind person, in putting together the elements of his experience.

We are now in a position to draw some inferences as to the differences in the composition or organization of experience in seeing and blind persons, as the results of the different age norms for various tests for the two classes of subjects. The blind seem, from the survey of this small group of persons, totally blind from birth or early childhood, to come *later* to the successful performance of the following tests:

1. Naming coins.
2. Giving day and date.
3. Pointing out remaining points of the compass when facing one.
4. Knox lines on fingers.
5. Patience with blocks.
6. Arranging disarranged sentences.
7. Definitions in terms superior to use.
8. Comprehension.
9. Absurdities.
10. Similarities.

1 and 2. No significance need be attached to 1 and 2. Naming coins is a matter of special training, of which the institution child has very little. Further, as already noted, the differentiation of a cent and dime by tactual impressions alone, is a very special process. Highly intelligent blind adults often take considerable time to distinguish these coins. There is no vital difference between the psychological processes of the congenitally blind in this test, and those of the subject with good vision, performing this experiment with his eyes closed. Giving day and date depends upon formal instruction, and is bound to vary with the practice of the school attended.

3. In the serious difficulty many of these subjects exhibit when asked to point to the remaining points of the compass while they know they are facing in a given direction, we encounter a real difference between the mental processes of blind and seeing subjects. Without vision it is impossible to get the same conceptions of space, and those space conceptions which are developed will be matured much more slowly. This is partly because human space conceptions utilize visual imagery,—in fact are largely visual schemata,—and the blind must find their own tactual and inner tactual substitutes for these, in order to construct the spacial aspects of their own experience, and come into possession of a framework upon which they can organize the communications of seeing subjects, and the literature they read. This construction of other than the visual imagery is in general a slower process, and results in an organization less adequate for the purposes of such larger orientation as is called for in this test. This test exhibits one of the marked handicaps under which those persons labor who are blind from birth or early childhood. No other imagery can be made to play the part of the visual in affording the large framework for spacial arrangement. Even in the matter of *pointing,* the blind rarely use the index finger alone, and very frequently the fingers are not extended. This follows naturally from the inability to appreciate fine differences in location. Could they see their own hands and arms, and could they sight a straight line, the procedure would take on a very different aspect to them. It would at once assume

definiteness of conception and precision of movement, which it lacks for them as blind. Even the poor vision of Group 4, very few of whom can see to read, but all of whom can see the way about, suffices to supply the synthetic space factor, so that their pointing is more definite, and their conceptions of location much more adequate.

4. Repeating Knox lines impressed by means of tactual imagery would hardly be expected to present the same amount of difficulty as the orientation test. However, it is an open question in the psychology of the genesis of space perception, in how far *visual imagery* affords the *scheme,* in the mind of a subject with normal vision, for the synthetic organization of outer and inner tactual impressions. It does seem clear that seeing subjects differ widely in this respect. Some habitually use visual forms for this purpose, and others make almost no use of visual forms for such synthesis. The results on the E, F, and G lines, and the higher age levels of given performances with the blind in average numbers of lines passed, however, do seem to indicate a greater difficulty with this sort of performance on the part of the blind. The assumption that visual imagery is the necessary synthetic factor for the seeing subject which binds together and organizes the inner tactual elements in a series of movements like a Knox line, would explain the poorer performance in the blind. The absence of vision, on such a theory, necessitates poorer work by the blind. We must not lose sight of the different character of the performance (finger tapping as compared to cube test) discussed on page 45. There is the interference of attention,—a characteristic embarassment in endeavoring to reorganize reflex and automatic movements. Both the absence of visual imagery, and the difficulty of getting control of automatized movements, play parts in the explanation of this relative retardation of the blind in repeating Knox lines.

5. In the Block Patience we have excellent illustration of the function of visual imagery as the synthetic element, by which the imagination organizes the special elements of experience. This evidence comes both from the procedure of the subject and

from the indication that this is probably a X-year test for the blind, whereas it is a V-year test for seeing children. If the blind child has any vision whatever, he gets the two pieces of the dissected block up very close to his eyes. The blocks, it will be recalled, are laid thus: on the table before him, after he has explored the whole block. The natural procedure for one proceeding wholly by touch would be to work with the blocks on the table, just as the seeing child works with the cards.

6. The longer time required for the arranging of the disarranged sentences is to be explained by the fact that reading by touch is slower than by vision. The blind subject is handicapped in speed of apperception, by his sense limitation. All of the tests involving space organization of experience which show retardation of the blind because they lack the synthesizing visual imagery, likewise involve and betray a lack in the blind of manual and general motor facility. Because they lack the guidance of visual control of their movements, the blind are less dextrous. For the same reason the blind person is less resourceful in dealing with his environment. To a certain extent he lacks initiative as compared with the seeing. By virtue of his sense deficiency, the environment makes fewer appeals to the activity of a blind child, than to a no more talented seeing child. The blind sits and reads or talks while the seeing child is trying out his powers, physical and mental, upon problems which have been thrust upon him.

From this compulsory reflection,—this way in which he is thrown in upon himself, we might expect the blind child to develope an agility of his wits and an effectiveness of the constructive imagination, superior to that of the seeing child. That this is not the case is shown by the backwardness of the blind in such tests as *comprehension, absurdities,* and *similarities.* That he is not more agile and skillful in handling such little problems demonstrates again that the really useful training of imagination and reasoning power occurs only by the personal handling of problems as they confront one in real life. There is no such thing as a perfection of pure reasoning *per se.* One learns to reason and to construct useful forms only as he is confronted

with practical difficulties, obstacles to the fulfillment of his desires. The constructive imagination organizes as the hands work out solutions to problems. In controlling movements constructive thinking is born and organized. So again this lack of mental agility falls right back upon the lack of manual dexterity, which in turn is traceable to the sense defect. The blind child does not experiment with the facts of life because they do not come to meet him as they do the seeing child, and because he can not exercise such skillful control of his own movements without vision. Because he does not experiment, he does not get the only effective training in that mental gymnastics which eventuates in constructive imagination,—in building up, as the result of his own maneuvers, the world of his inner experience, and gaining that power which deals more and more effectively with novel situations.

The tests in which the blind show themselves superior to seeing subjects are:

1. Repetition of digits.
2. Reversing series of digits.
3. Arithmetical reasoning.
4. Rhyming.
5. Naming the months.

These are results which one might predict from the sense defect and the kind of formal training which results. Verbal memory for figures is absolutely essential to any progress in arithmetic by the blind. And the arithmetic must be largely oral. Series of numbers remembered, is the first essential to reversing a series. The arithmetical problems are simple oral arithmetic problems. Reversing a series and the solution of these problems seem to involve, at first sight, the same kind of mental ability as that we just found underdeveloped in *comprehension* and *absurdity* tests. It is the same with a difference. Numbers and number work may be highly abstract, whereas these absurdity tests and comprehension tests deal with practical situations. To deal with the latter, one must actualize in his imagination the really human situation to a nicety of detail. In numbers we have a line of mathematical conceptions which serve as examples

of the purest logic. One can handle them successfully without any reference to the real world. It is in the application of his powers to practical problems that the blind finds himself handicapped.

The same point is emphasized by contrasting rhyming, in which the blind is proficient, with reasoning out of complex situations, in which he is backward. The purely formal language manipulation (rhymes) is a thing he practices upon. The child joy, in sound as such, has made a great appeal to him. But the practical use of language to depict actual situations does not get at him so intimately for the situation does not confront him so closely. He can not grasp its intricacies because he lacks the capacity to see it in the large. These proficiencies of the blind result in part in his interest in the purely formal, and in part from the accidents and emphases of his school instruction.

X

Partial Scales for Mental Measurement Emerging From the Use of Binet and Other Single Tests

1. In the year scale employed by Binet, the use of pictures serves at once as a partial scale: mere enumeration being a III-year performance, description, a VII-year performance, and interpretation, indicating a XV-year level. Likewise, Binet's 1911 series uses memory span for digits as follows:

2 digits = III years.
3 digits = IV years.
5 digits = VIII years.
7 digits = XV years.

For the blind these standards are advanced. We followed Yerkes in introducing 4 and 6 digits, and Terman in introducing 8.

2. Terman's suggestion, introducing 3 and 5 digit series to be given backwards, led us to series of 3, 4, 5, and 6 digits. This test entails memory span for digits, and, in addition, a longer retention and manipulation while retained. It is a complex reconstruction of a series of ideas, entailing a skillful division of attention.

3. Terman's 1″, 2″, 3″, and 4″ Degrees of Comprehension constitute a valuable elaboration and grading of the material of Binet's IX and X-year *comprehension test.* This grading of the material has constituted of it a scale for measuring a subject's capacity to manipulate ideas which are complex and concrete, but presented purely verbally. It measures power for constructive thinking.

4. Terman's *similarities* of *two* and of *three* objects present two measurement levels of the development of analytic thinking. This kind of analytic thinking is later in its appearance than Binet's Differences. Roughly we have a three member scale series in the Difference test and these two grades of Similarities.

5. Binet's XII-year test of 60 words given in three minutes,

has been converted into a scale by the Yerkes-Bridges method of scoring. One can just as well standardize words for years. Forty words and 80 words seem as definitely standard for given years, as do 60.

6. Binet's 1908 X-year *Memories of a Selection Read,* or a simplified and lengthened narrative, either given to the subject to read aloud, or read to him, has in the number of items remembered, and the time required for recollection, the elements necessary for yielding standards for several levels of intelligence development. The number of items recalled is the important feature.

7. Wyatt's Analogies, which Yerkes and Bridges use, afford an efficient measure of the higher development of the capacity to maneuver ideas in relation to each other. The mental processes measured are not unlike those of the similarities tests. They are primarily analytical. They involve more free association to get the right idea into the field of attention. The scale is constituted by the numbers of the six analogies given correctly and the correlation of these numbers with stages of development.

8. The Knox Lines (Knox Cube Test) as developed by Pintner, constitute a scale for assessing intelligence development. Pintner has grouped the lines and endeavored to correlate performance in groups with years of chronological age. Because of irregularities of the grading of the lines it seems to me highly desirable to scale individual performances on the total number of lines, out of the eleven lines given, which given subjects re-present correctly.

9. Binet's X-year Test of Five Absurd Sentences, likewise, contains the germs of a scale setting standards of performance. The absurdities themselves are of different degrees of intricacy of organization. They could easily be developed into a series of much greater range of intricacy. In this Binet series, however, 1, 2, 3, 4, and 5 correct answers may each be correlated with a grade of intelligence development.

The point of this presentation of the germs of scales for intelligence measuring, which emerge from year scale tests and

the results therefrom, lies in this: Considered from the point of view of developmental psychology, the complex of mental performance measured by any given Binet test, is not something which emerges full formed, as Athene from the head of Zeus, at a given moment, or in a given year of the child's life. All these capacities for complicated performance grow gradually. We know that it is useless in general to present the problems of geometry to children of less than thirteen years of age. Likewise, it is useless to expect a ten-year old to answer more than one or two of Wyatt's Analogies, or an eight-year old to deal intelligently with more than two of Binet's Absurdities, or to *interpret* the pictures.

Upon this foundation rests the justification of any Point Scale for measuring the development of intelligence. The aim is to measure all the mental capacities of a given subject, and, as a result of his attainments in all these various lines, to compare him with other persons of similar origins, age, sex, training, and station in life, and to bring out of this comparison a statement not only *quantitative,* as to *how much* he is above or below the average of his class, but also a *qualitative* statement from the point of view of the psychology of character formation, as to what elements or *what kinds* of *mental organization* are inadequately or super-abundantly represented in his make-up.

The point scale, therefore, is not merely an attempt to economize effort in mental examination, and to secure the same results, as obtained by a year scale examination, in an easier way. It is a far more ambitious undertaking, actuated by an intelligent appreciation of the need for the application of rigidly scientific methods to the analysis of human nature. If our psychology is a science of mental processes,—if psychology does constitute any real analytic knowledge of the make-up and development of the inner nature of human beings, this knowledge must be applied in this field of mental tests. We must standardize performance (functioning) in all possible fields, when these fields are marked out by a logical procedure, and we must provide measuring instruments of precision for each one of these fields, which shall enable us to arrive at percentage values of any individual's

performance therein. Of course, psychology has not marked out these fields. Meanwhile, practical situations will not wait. The demands come from every side for the assaying of human nature. Human beings who are delinquent, or otherwise presenting problems to courts and school systems, are sent to psychologists for analysis. The courts and schools and parents are clamoring for expert guidance in the solution of their problems.

It seems that this practical field is the proper laboratory in which to work out the classification and development of human organization. Practical psychology must set about the scientific study of just this problem. Its solution will be found in the study of the shortcomings and perversions of human nature, rather than in what is commonly called the psychological laboratory, where normal persons work with measuring instruments of precision. And it is with this conviction firmly organized within his plan of procedure, that the psychologist proposes a point scale to replace the cruder year scale for measuring intelligence. It is not an instrument of precision, and it can not proceed upon the basis of a logical analysis of human nature. Such analysis does not exist. Until such exists any method of assessing intelligence development must be crudely applied. Procedure in mental examination upon such analysis of human nature as we do possess,—measuring in all persons certain actual human capacities to perform, is the only rational procedure, and one which necessity lays upon us. It is also the procedure *most* likely to produce a more logical analysis of human nature. It is the best application of the logic we possess, and holds out the best promise of bringing us forward to a better logic.

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